

IUPAC
INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY



COMPTES RENDUS XXVII CONFERENCE — PART A

MUNICH
21—31 August 1973

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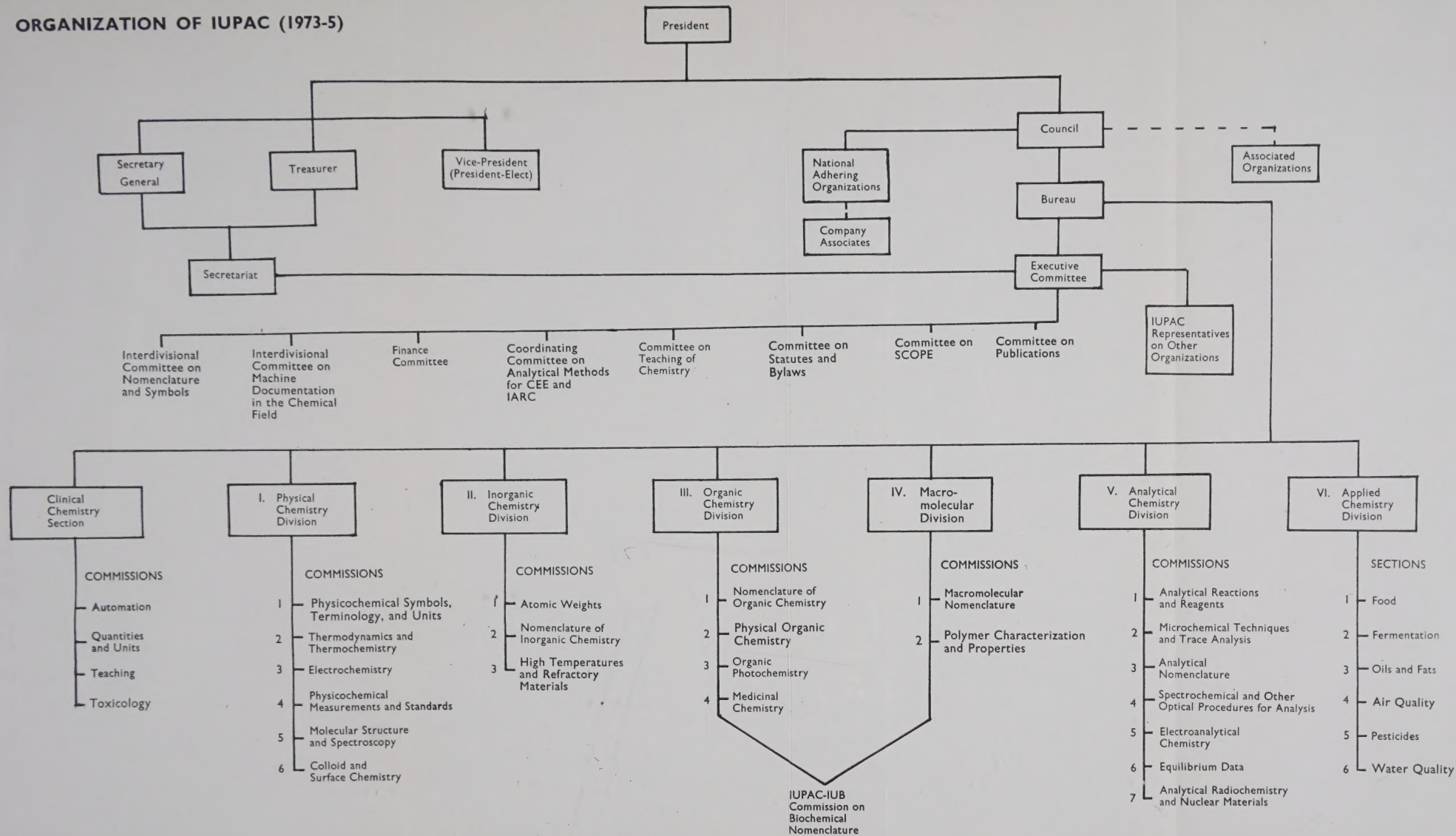
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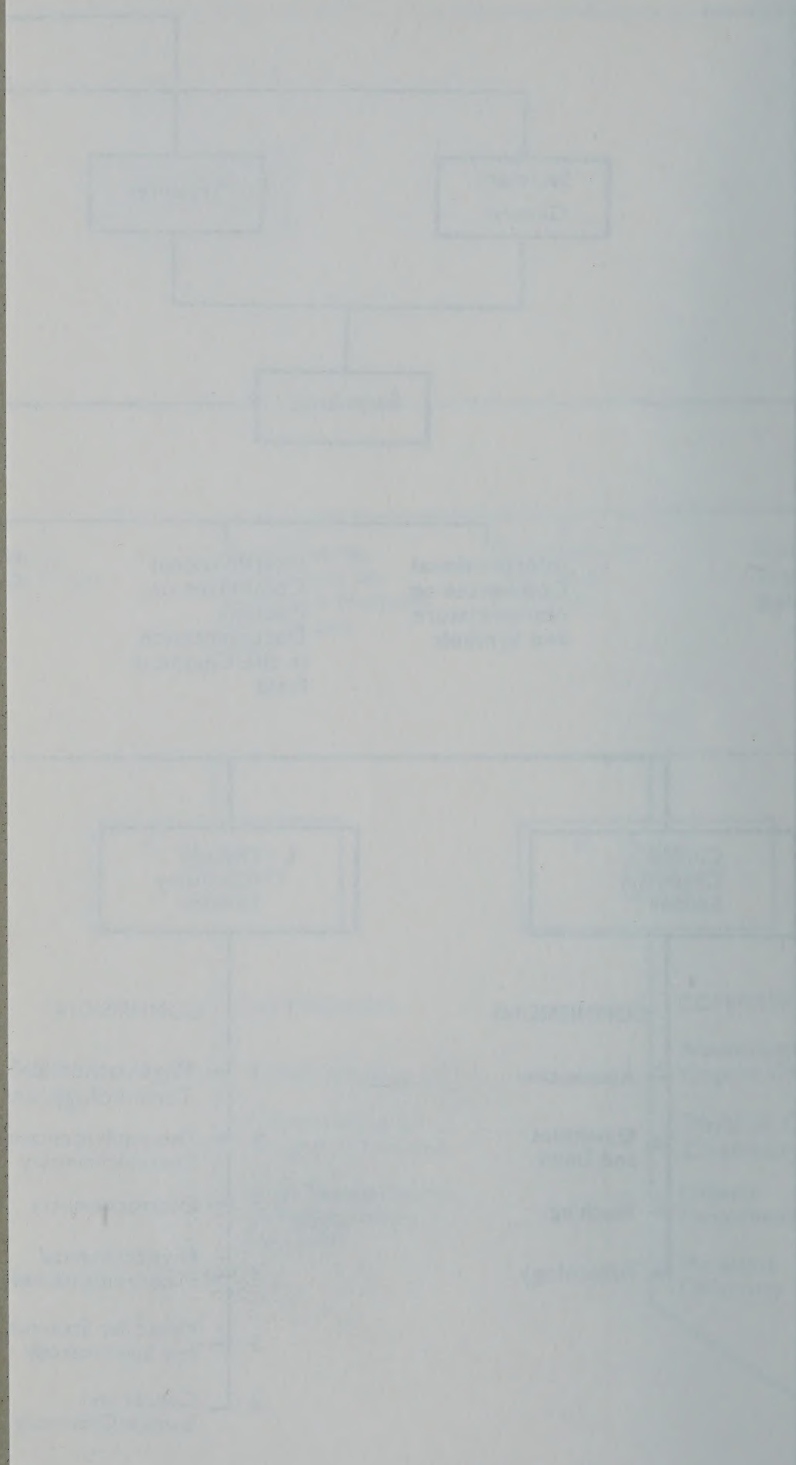
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ORGANIZATION OF IUPAC (1973-5)







IUPAC
INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY



COMPTES RENDUS XXVII CONFERENCE

— PART A

MUNICH
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- 1973–1977 BARTON, Prof. Sir DEREK
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- 1971-1975 BERGMANN, E. D., Prof.
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- 1973-1977 COLE, A. R. H., Prof.
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- 1971-1975 EMANUEL, N. M., Prof.
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- 1969-1977 GLEMSE, O., Prof.
Anorganisch-Chemisches Institut der Universität Göttingen
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Germany)
- 1969-1977 HEROUT, V., Prof.
Institute of Organic Chemistry and Biochemistry
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- 1971-1975 ISLER, O., Dr.
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- 1969-1977 RANGASWAMI, S., Prof.
Department of Chemistry, University of Delhi
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- 1967-1975 SHIBATA, S., Prof.
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- 1969-1977 SMETS, G., Prof.
Laboratorium voor Macromoleculaire en Organische
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- 1969-1977 SUOMALAINEN, H., Prof.
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Physical Chemistry (I)

- 1973–1977 JONES, R. N., Dr.
Division of Chemistry, National Research Council of Canada
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Inorganic Chemistry (II)

- 1973–1977 GUTMANN, V., Prof.
Institut für Anorganische Chemie der Technischen Hochschule
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Getreidemarkt 9, A-1060 Wien (Austria)

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- 1973–1975 KJAER, A., Prof.
Organisk-Kemisk Laboratorium, Danmarks Tekniske Højskole
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- 1971–1975 BENOIT, H., Prof.
Centre de Recherches sur les Macromolécules, Centre National
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- 1973–1977 TANAKA, N., Prof.
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- 1973–1977 EGAN, H., Dr.
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Burlington House, Piccadilly, London W1V 0BN (UK)
- 1969– GRÜNEWALD, H., Dr.
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Boschstrasse 12, D-6940 Weinheim (Federal Republic of Germany)
- 1969– KENYON, R. L., Dr.
American Chemical Society
1155 Sixteenth Street NW, Washington, DC 20036 (USA)
- 1973– PEREZ-MASÍÁ, A., Prof.
Instituto de Química Física "Rocasolano", Consejo Superior de Investigaciones Científicas
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Scientific Editor

- 1969– WEEDON, B. C. L., Prof.
Department of Chemistry, Queen Mary College
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PURE AND APPLIED CHEMISTRY (PAC)

Official Journal of IUPAC

Scientific Editor

- 1959– WEEDON, B. C. L., Prof.
Department of Chemistry, Queen Mary College
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Assistant Scientific Editor

- 1964– CULLIS, C. F., Prof.
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* For Standing Orders, see page 116.

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- 1971- TRUHAUT, R., Prof.
Chaire de Toxicologie, Faculté de Pharmacie, Université de Paris
4 Avenue de l'Observatoire, F-75006 Paris Cedex 06 (France)
- 1971- WEST, P. W., Prof.
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- 1972- REES, A. L. G., Dr.
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* For Standing Orders, see page 117.

† For Standing Orders, see page 118.

- 1972- SUOMALAINEN, H., Prof.
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- 1972- WADDINGTON, G., Dr.
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- 1964- CAMPBELL, J. A., Prof.
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- 1974- HELLMANN, H., Prof.
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- 1969- PLATÉ, A. F., Prof.
Chair of Petrochemistry and Organic Catalysis, Department of
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- 1971- RAO, C. N. R., Prof.
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- 1964- SYKES, P., Dr.
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- 1973- VITOROVIČ, D., Prof.
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* For Standing Orders, see page 119.

National Representatives

- Arab Republic of Egypt* 1973– SADEK, H., Dr.
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- Austria* 1971– MASCHKA, A., Prof.
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- Brazil* 1971– GIESBRECHT, E., Prof.
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- Bulgaria* 1972– BLIZNAKOV, G., Prof.
Department of Inorganic Chemistry, Faculty of Chemistry
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Sofia
- Canada* 1970– NEWBOLD, B., Prof.
Department of Chemistry, University of Moncton
Moncton, New Brunswick
- Colombia* 1970– NIÑO, L. C., Dr.
Departamento de Química, Ciudad Universitaria
Bogotá
- Cuba* 1972– BERTRÁN, J. F., Dr.
Viceministerio para la Enseñanza Superior, Ministerie
de Educación
Obispo y Mercaderes, La Habana
- Czechoslovakia* 1973– GAŽO, J., Prof.
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- Denmark* 1970– RANCKE-MADSEN, E., Prof.
Kemisk Institut, Danmarks Laererhøjskole
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- Federal Republic of Germany* 1969– DIMROTH, K., Prof.
Chemisches Institut der Universität
Bahnhofstrasse 7, D-3550 Marburg/Lahn
- Finland* 1970– ANTIKAINEN, P. J., Prof.
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- France*
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Association of Greek Chemists
27 Kaningos Street, Athens 147
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1970- SUBBA RAO, N. V., Prof.
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- Ireland*
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- Israel*
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- Italy*
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1970- MUTO, G., Prof.
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- Mexico*
1971- SAHAGÚN, A. B., Prof.
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- Netherlands*
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School of Mathematical and Physical Sciences, Faculty of Science
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- Norway*
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- Poland*
1972- JEŻOWSKA-TRZEBIATOWSKA, B., Prof.
Instytut Chemii, Uniwersytet Wrocławski
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- Portugal* JACOBSON, K., Prof.
1971– Faculdade de Ciências, Laboratório de Química
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- Republic of China* PENG, YU-TSAI, Prof.
1970– Department of Chemistry, National Taiwan Normal University
Ho-ping Road East, Taipei, Taiwan
- Republic of Korea* SANG UP CHOI, Dr.
1972– Korean Chemical Society
35, 5-Ka Anam-Dong, Sungbuk-ku, Seoul
- Republic of South Africa* ARNDT, R. R., Prof.
1973– Department of Chemistry, Randse Afrikaanse Universiteit
POB 524, Johannesburg
- Republic of Vietnam* LE-VAN-THOI, Prof.
1970– Vietnamese Chemical Society
c/o Atomic Energy Office, POB Q-16, Saigon
- Romania* SIMIONESCU, C., Prof.
1970– Akademia Republicii Socialiste România
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- Spain* MORCILLO RUBIO, J., Prof.
1972– Facultad de Ciencias, Universidad de Madrid
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- Sweden* LEDEN, I., Prof.
1969– Chemical Center, University of Lund
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- Switzerland* DREIDING, A. S., Prof.
1970– Organisch-Chemisches Institut der Universität
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- Turkey* BERKEM, A. R., Prof.
1971– Istanbul Üniversitesi Kimya Fakültesi
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- United Kingdom* ROBINSON, M. D., Dr.
1969– Chemical Society
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- United States of America* COOK, W. B., Prof.
1970– College of Natural Sciences, Colorado State University
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- Venezuela* CORTÉS, L., Dr.
1971– Escuela de Química, Universidad Central de Venezuela
Caracas

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Chairman, Commission VI.1.2

- 1973–1975 KOJIMA, K., Dr.
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30, Kasukabe, Kasukabe-shi, Saitama-ken 344 (Japan)

Chairman, Section VI.4

- 1971-1975 MONKMAN, J. L., Mr.
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Chairman, Section VI.5

- 1971-1975 ABBOTT, D. C., Dr.
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(Established in its present form 1963)

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- 1971- BEAVERS, E. M., Dr.
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- 1967- BROCARD, J., Mr.
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- 1971- BJÖRKMAN, A., Prof.
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- 1971- HOSHINO, K., Dr.
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- 1973- ZAIKOV, G. E., Prof.
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Ex-officio Member

- 1971- HORN, O., Prof.
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*For Standing Orders, see page 120.

***INTERDIVISIONAL COMMITTEE ON MACHINE DOCUMENTATION IN THE CHEMICAL FIELD (IDCMD)**

(Established 1969)

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- 1969- DUBOIS, J. E., Prof.
Laboratoire de Chimie Organique Physique, Université de
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- 1973- VEAL, D. C., Dr.
United Kingdom Chemical Information Service, University of
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(TEL: 0602 57411)

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- 1970- BOKII, G. B., Prof.
National Committee of Soviet Chemists
c/o Institute of Chemical Physics, Academy of Sciences of USSR
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- 1969- VAN EYK VON VOORTHUYSEN, J. B., Dr.
Netherlands Organization for Chemical Information
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(Netherlands)
- 1973- FUJIWARA, S., Prof.
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3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)
- 1969- SCHENK, H. R., Dr.
Chemical Research, Pharmaceutical Division, Sandoz AG
CH-4002 Basel (Switzerland)
- 1969- SUHR, C., Dr.
Patentabteilung/Dokumentation, Badische Anilin- und Soda-
Fabrik AG
D-6700 Ludwigshafen/Rhein (Federal Republic of Germany)
- 1969- TATE, F. A., Dr.
Chemical Abstracts Service, Ohio State University
POB 1378, Columbus, Ohio 43210 (USA)

*For Standing Orders see page 121.

INTERDIVISIONAL COMMITTEE ON NOMENCLATURE AND SYMBOLS (IDCNS)

(Established in its present form 1965)

Chairman

- 1972–
McGLASHAN, M. L., Prof.
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Stocker Road, Exeter EX4 4QD, Devon (UK)
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Secretary

Chairman, Commission V.3

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IRVING, H. M. N. H., Prof.
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Leeds LS2 9JT (UK)
(TEL: 0532 31751)

Members

Chairman, Commission on Biochemical Nomenclature

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HOFFMANN-OSTENHOF, O., Prof.
Lehrkanzel für Biochemie der Universität Wien
Währingerstrasse 38, A-1090 Wien (Austria)

Chairman, Commission on Quantities and Units in Clinical Chemistry

- 1970–
DYBKAER, R., Dr.
Department of Clinical Chemistry, Geriatric Unit, De Gamles By
Nørre Allé 41, DK-2200 København N (Denmark)

Chairman, Commission I.1

- 1973–
WHIFFEN, D. H., Prof.
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Chairman, Commission II.2

- 1971–
FERNELIUS, W. C., Prof.
Department of Chemistry, University of South Florida
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Chairman, Commission III.1

- 1971–
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- 1969–
LOENING, K. L., Dr.
Chemical Abstracts Service, Ohio State University
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Applied Chemistry Division

- 1969–
PIRT, S. J., Prof.
Department of Microbiology, Sir John Atkins Laboratories
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IUPAC-IUB COMMISSION ON BIOCHEMICAL NOMENCLATURE (CBN)

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Währingerstrasse 38, A-1090 Wien (Austria)
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1967-1975 Institut für Physiologische Chemie, Institutsgruppe Lahnberge
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- IUPAC KLYNE, W., Prof.
1965-1975 Department of Chemistry, Westfield College
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- 1966-1974 KLEMM, W., Prof.
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- 1970-1975 SCHUIT, G. A., Prof.
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- 1970-1975 TAMAMUSHI, R., Dr.
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2-1 Hirosawa, Wako-shi, Saitama 351 (Japan)
- 1970-1975 VEDENEV, V. I., Dr.
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- 1973-1975 KERTES, A. S., Prof.
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ICSU Committee on Teaching of Science

- 1969-1975 CHISMAN, D. G., Mr.
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ICSU Scientific Committee on Water Research (COWAR)

- 1972-1975 PEARSON, E. A., Prof.
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ICSU Scientific Committee on Problems of the Environment (SCOPE)

- 1970-1975 GALLAY, W., Dr.
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Inter-Union Commission on Spectroscopy (IUCS)

- 1968-1974 FASSEL, V. A., Prof.
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- 1968-1974 JONES, R. N., Dr.
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- 1971-1977 COLE, A. R. H., Prof.
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- 1971-1977 MORINO, Y., Prof.
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International Association for Cereal Chemistry (ICC)

- 1973-1975 PARISI, F., Dr.
Società Chimica Italiano—Sezione Lombardo
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International Congress on Catalysis

- 1969-1975 EVERETT, D. H., Prof.
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International ad hoc Committee on Chemotaxonomy

- 1974-1975 GRÜNEWALD, H., Dr.
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- 1974-1975 LOENING, K. L., Dr.
Chemical Abstracts Service, Ohio State University
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International Organization for Crystal Growth (IOCG)

- 1973-1975 COLLONGUES, R., Prof.
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Comité Consultatif des Unités de Comité International des Poids et Mesures

ISO/TC 12: Quantities, Symbols, Conversion Factors, and Conversion Tables

ISO/TC 12/SC 2: General Rules for Use of SI Units, Their Multiples and Submultiples in Various Industries

- 1970-1975 MCGLASHAN, M. L., Prof.
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ISO/TC 47/SC 3: Reagents for Chemical Analysis

- 1971-1975 STEPHEN, W. I., Dr.
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World Health Organization (WHO)

- 1972-1975 MORF, R., Dr.
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SECTION ON CLINICAL CHEMISTRY (CCS)

(Attached to Bureau. Established in its present form 1967)

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- 1971-1975 SUNDERMAN, Jr., F. W., Prof.
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- 1971-1975 HOMOLKA, J., Prof.
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- 1973-1975 LATNER, A. L., Prof.
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- 1971-1975 RUBIN, M., Prof.
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1972- Kanematsu Memorial Institute, Sydney Hospital
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1972- Laboratorium voor Medische, Biochemie en Klinische Analyse
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- Hungary* RINGELHANN, B., Dr.
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- Japan* YAMAMURA, Y., Prof.
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1969– Department of Clinical Chemistry, Ulleval Hospital
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- Poland* KRAWCZYŃSKI, J., Prof.
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1971– Faculdade de Ciências, Laboratório de Química
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1973– Department of Clinical Chemistry, Sahlgren's Hospital
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- Union of Soviet Socialist Republics* OREKHOVICH, V. M., Prof.
1967– Institute of Biological and Medical Chemistry, Academy of
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- United Kingdom* MITCHELL, F. L., Dr.
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- United States of America* MELVILLE, R. S., Dr.
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1973-1975 BIERENS DE HAAN, J., Dr.
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COMMISSION ON QUANTITIES AND UNITS (CQUCC)

(Established 1967)

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- 1967-1975 ARMBRECHT, B. H., Dr.
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- 1971-1975 HERRMANN, R., Prof.
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- 1967-1975 MÉTAIS, P., Prof.
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- 1973-1977 RIGG, J. C., Mr.
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COMMISSION ON TEACHING (CTeCC)

(Established 1967)

Titular Members

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- 1973-1975 PORTER, C. J., Dr.
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- 1973-1975 SCHWARTZ, M., Dr.
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COMMISSION ON TOXICOLOGY (CToCC)

(Established 1973)

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- 1973-1977 BROWN, S. S., Dr.
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- 1973-1977 BOURDON, R., Prof.
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- 1974-1975 MERCIER, M. J. G., Prof.
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- 1974-1975 TONKS, D. B., Dr.
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I PHYSICAL CHEMISTRY DIVISION

(Established 1949)

DIVISION COMMITTEE

President

- 1969-1977 JONES, R. N., Dr.
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Past-President

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- 1971-1975 EVERETT, D. H., Prof.
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- 1973-1977 HAASE, R., Prof.
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- 1973-1977 GURVICH, L. V., Prof.
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- 1971-1975 KIENITZ, H., Prof.
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- 1973-1977 WESTRUM, JR., E. F., Prof.
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I.1 COMMISSION ON PHYSICO-CHEMICAL SYMBOLS, TERMINOLOGY, AND UNITS

(Established in its present form 1936)

Titular Members

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Secretary

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- 1971–1975 KOEFOED, J., Prof.
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- 1971–1975 LIDE, JR., D. R., Dr.
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- 1967–1975 PEREZ-MASIÁ, A., Prof.
Instituto de Química Física 'Rocasolano', Consejo Superior de
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Serrano 119, Madrid-6 (Spain)
- 1971–1975 SCHUIFF, A., Dr.
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- 1971–1975 WEIL, K. G., Prof.
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Associate Members

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- 1973–1975 PAUL, M. A., Dr.
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National Research Council, National Academy of Sciences
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- 1973-1975 STILLE, U., Prof.
Physikalisch-Technische Bundesanstalt
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Germany)
- 1969-1975 TERRIEN, J., Prof.
Bureau International des Poids et Mesures
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I.2 COMMISSION ON THERMODYNAMICS AND THERMOCHEMISTRY

(Established in its present form 1961)

Titular Members

Chairman

- 1969–1977 WESTRUM, JR., E. F., Prof.
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Secretary

- 1973–1977 LAFFITTE, M., Prof.
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- 1973–1977 BECKETT, C. W., Dr.
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- 1969–1977 COX, J. D., Dr.
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- 1969–1977 GURVICH, L. V., Prof.
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- 1967–1975 SEKI, S., Prof.
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- 1967–1975 VODAR, B., Prof.
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- 1973–1977 WÄDSO, I., Dr.
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- 1973-1975 HÁLA, E., Prof.
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- 1973-1975 KOHLER, F., Prof.
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- 1972-1975 ROWLINSON, J. S., Prof.
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- 1973-1975 SCHNEIDER, G. M., Prof.
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- 1973-1975 TAKAHASHI, Y., Prof.
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- 1973-1975 WHALLEY, E., Dr.
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I.2.1 SUB-COMMISSION ON PLASMA CHEMISTRY

(Established 1969)

Chairman

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- 1973-1975 BELL, A. T., Prof.
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- 1973-1975 BONET, C., Dr.
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- 1972-1975 FOEX, M., Dr.
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- 1972-1975 HOLLAHAN, J. R., Dr.
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- 1972-1975 JENSEN, D. E., Dr.
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- 1972-1975 McTAGGART, F. K., Dr.
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- 1973-1975 MATSUMOTO, O., Prof.
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- 1972-1975 MOLINARI, E., Prof.
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- 1972-1975 POLAK, L. S., Prof.
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- 1972-1975 YOUNG, R. A., Prof.
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I.2.2 SUB-COMMISSION ON THERMODYNAMIC TABLES

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- 1973–1975 KEHIAIAN, H., Dr.
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- 1972–1975 ROWLINSON, J. S., Prof.
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- 1973–1975 SYTCHEV, V. V., Dr.
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- 1972–1975 WHITE, JR., H. J., Dr.
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I.3 COMMISSION ON ELECTROCHEMISTRY

(Established 1951)

Titular Members

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- 1967–1975 EPELBOIN, I., Prof.
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- 1971–1975 IBL, N., Prof.
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- 1969-1975 GERISCHER, H., Prof.
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- 1971-1975 MOHILNER, D., Prof.
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Fort Collins, Colorado 80521 (USA)
- 1971-1975 PLAMBECK, J. A., Prof.
Department of Chemistry, University of Alberta
Edmonton 7, Alberta (Canada)
- 1971-1975 PLESKOV, Yu. V., Prof.
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National Representatives

- Hungary*
1969- ERDEY-GRÚZ, T., Prof.
Eötvös Loránd Tudományegyetem Fizikai-Kémiai és
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- New Zealand*
1973- TOMLINSON, J. W., Prof.
Department of Chemistry, Victoria University of Wellington
POB 196, Wellington
- Poland*
1959- MINČ, S., Prof.
Uniwersytet Warszawski
Ul. Pasteura 1, Warszawa 22
- Spain*
1959- RIUS-MIRÓ, A., Prof.
Instituto de Química Física "Rocasolano", Consejo Superior
de Investigaciones Científicas
Serrano 119, Madrid-6
- Yugoslavia*
1959- KARSULIN, M., Prof.
Institute of Physical Chemistry, Technical University
Maruliceva Trg. 20, Zagreb

COMMISSION ON PHYSICOCHEMICAL MEASUREMENTS AND STANDARDS

(Established in its present form 1953)

Titular Members

Chairman

- 1971-1975 AMBROSE, D., Dr.
Division of Chemical Standards, National Physical Laboratory
Department of Industry
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Vice-Chairman and Secretary

- 1971-1975 CALI, J. P., Dr.
National Bureau of Standards, US Department of Commerce
Washington, DC 20234 (USA)
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Members

- 1973-1977 BRUNNER, E., Dr.
Badische Anilin- und Soda-Fabrik AG, Ammoniaklabora-
torium WAA/M325
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- 1971-1975 GRAHAM, R. P., Dr.
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- 1973-1977 LANE, J. E., Dr.
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Industrial Research Organization
POB 4331, Melbourne, Victoria (Australia 3001)
- 1967-1975 MASHIKO, Y., Dr.
National Chemical Laboratory for Industry, Ministry of
International Trade and Industry
1-1, Honmachi, Shibuya-ku, Tokyo 151 (Japan)
- 1973-1977 PLEBANSKI, T., Prof.
Polish Committee of Standardization and Measures
Ul. Elektoralna 2, PL 00-139 Warszawa (Poland)
- 1973-1977 TERRIEN, J., Prof.
Bureau International des Poids et Mesures
Pavillon de Breteuil, F-92310 Sèvres (S-&-O) (France)

Associate Members

- 1973-1975 BROWN, I., Dr.
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- 1973-1975 FEUERBERG, H., Prof.
Bundesanstalt für Materialprüfung
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- 1969–1975 JUHÁSZ, A., Dr.
National Office of Measurements
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- 1973–1975 KIENITZ, H., Prof.
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- 1973–1975 MILAZZO, G., Prof.
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Viale Regina Elena 299, I-00161 Roma (Italy)
- 1971–1975 SMIT, W. M., Dr.
Fysisch Chemisch Instituut, Organisatie voor Toegepast
Natuurwetenschappelijk Onderzoek
POB 108, Zeist (Netherlands)
- 1967–1975 STAVELEY, L. A. K., Dr.
Inorganic Chemistry Laboratory, University of Oxford
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- 1971–1975 STULL, D. R., Dr.
Dow Chemical Co., 1707 Building
Midland, Michigan 48640 (USA)

National Representatives

- Czechoslovakia* MATRKA, M., Dr.
1974– Research Institute for Organic Syntheses
CS-532 18 Pardubice-Rybitví
- India* MUKHERJEE, J. N., Dr.
1961– 10 Puran Chand Nahar Avenue, Calcutta-13
- Italy* MILONE, M., Prof.
1953– Chemical Institute, University of Torino
Corso Massimo d'Azeglio 48, Torino
- United Kingdom* NEWTON, A., Mr.
1973– Petrochemical Division, Imperial Chemical Industries Ltd.
POB 2, Organic House, Billingham, Teesside TS23 1JB

I.4.1 SUB-COMMISSION ON CALIBRATION AND TEST MATERIALS

(Established 1972)

Chairman

- 1973-1975 KIENITZ, H., Prof.
Badische Anilin- und Soda-Fabrik AG, Forschung WOH/B 9
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Members

- 1973-1975 AMBROSE, D., Dr.
Division of Chemical Standards, National Physical Laboratory
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- 1973-1975 BROWN, I., Dr.
Division of Applied Chemistry, Commonwealth Scientific and
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POB 4331, Melbourne, Victoria (Australia 3001)
- 1973-1975 BRUNNER, E., Dr.
Badische Anilin- und Soda-Fabrik AG, Ammoniaklabora-
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- 1973-1975 CALI, J. P., Dr.
National Bureau of Standards, US Department of Commerce
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- 1973-1975 COX, J. D., Dr.
Division of Chemical Standards, National Physical Laboratory
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Teddington TW11 0LW, Middlesex (UK)
- 1974-1975 GREEN, J. H. S., Dr.
Division of Chemical Standards, National Physical Laboratory
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Teddington TW11 0LW, Middlesex (UK)
- 1973-1975 HERINGTON, E. F. G., Dr.
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- 1973-1975 JUHÁSZ, A., Dr.
National Office of Measurements
Németvölgyi Út 37, H-1124 Budapest XII (Hungary)
- 1973-1975 MILAZZO, G., Prof.
Laboratorio di Chimica, Istituto Superiore di Sanità
Viale Regina Elena 299, I-00161 Roma (Italy)
- 1973-1975 PLEBANSKI, T., Prof.
Polish Committee of Standardization and Measures
Ul. Elektoralna 2, PL 00-139 Warszawa (Poland)
- 1973-1975 ZIEBLAND, H., Dr.
Process Research Procurement Executive, Explosives Research
and Development Establishment, Ministry of Defence
Powdermill Lane, Waltham Abbey, Essex EN9 1BP (UK)

I.5 COMMISSION ON MOLECULAR STRUCTURE AND SPECTROSCOPY

(Established 1955)

Titular Members

Chairman

- 1967–1975 SHEPPARD, N., Prof.
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Vice-Chairman

- 1967–1975 ELYASHÉVICH, M. A., Prof.
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Secretary

- 1967–1975 MILLER, F. A., Prof.
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- 1973–1977 BECKER, E. D., Dr.
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- 1973–1977 BEYNON, J. H., Dr.
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- 1971–1975 FLUCK, E., Prof.
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- 1969–1977 HADNI, A., Prof.
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2 Rue de la Craffe, Nancy (France)
- 1973–1977 ZERBI, G., Prof.
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Associate Members

- 1970–1975 HERZBERG, G., Dr.
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Ottawa 7, Ontario K1A 0R6 (Canada)
- 1971–1975 JEŻOWSKA-TRZEBIATOWSKA, B., Prof.
Instytut Chemii, Uniwersytet Wrocławski
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- 1969-1975 LIPPINCOTT, E. R., Prof.
Department of Chemistry, University of Maryland
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- 1973-1975 MORINO, Y., Prof.
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(Japan)
- 1969-1975 NAGAKURA, S., Prof.
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- 1971-1975 RAO, C. N. R., Prof.
Department of Chemistry, Indian Institute of Technology
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- 1967-1975 THOMPSON, Prof. Sir HAROLD
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- 1969-1975 TURNER, D. W., Dr.
Physical Chemistry Laboratory, University of Oxford
South Parks Road, Oxford OX1 3QZ (UK)

I.5.1 SUB-COMMISSION ON INFRARED AND RAMAN SPECTROSCOPY

(Established 1965)

Chairman

- 1965-1975 COLE, A. R. H., Prof.
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(TEL: 80 3162)

Members

- 1971-1975 BRODERSEN, S., Prof.
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- 1965-1975 CRAWFORD, JR., B. L., Prof.
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- 1973-1975 DURIG, J. R., Prof.
Department of Chemistry, University of South Carolina
Columbia, South Carolina 29208 (USA)
- 1969-1975 JOSIEN, M. L., Prof.
Laboratoire de Chimie Physique du Centre National de la
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2 Rue Henri Dunant, F-94320 Thiais (France)
- 1965-1975 MILLS, I. M., Prof.
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- 1973-1975 SCHUTTE, C. J. H., Prof.
Department of Chemistry, University of South Africa
POB 392, Pretoria (Republic of South Africa)
- 1971-1975 WILLIS, H. A., Mr.
Plastics Division, Imperial Chemical Industries Ltd.
POB 6, Bessemer Road, Welwyn Garden City, Hertfordshire
(UK)

I.5.2 SUB-COMMISSION ON STORAGE AND RETRIEVAL OF SPECTROSCOPIC DATA

(Established 1963)

Chairman

- 1963-1975 LIDE, JR., D. R., Dr.
Office of Standard Reference Data, National Bureau of
Standards, US Department of Commerce
Washington, DC 20234 (USA)
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- 1967-1975 ELYASHÉVICH, M. A., Prof.
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- 1971-1975 FREI, K., Dr.
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- 1973-1975 JONES, R. N., Dr.
Division of Chemistry, National Research Council of Canada
Ottawa 7, Ontario K1A 0R6 (Canada)
- 1973-1975 MACDONALD, R. S., Dr.
Materials Characterization Operation, General Electric
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- 1967-1975 SHIMANOUCI, T., Prof.
Department of Chemistry, Faculty of Science, University of
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3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)

I.5.3 SUB-COMMISSION ON MASS SPECTROSCOPY

(Established 1971)

Chairman

- 1973-1975 BEYNON, J. H., Dr.
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- 1973-1975 BECKEY, H. D., Prof.
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- 1973-1975 BIEMANN, K., Prof.
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- 1973-1975 LOSSING, F. P., Dr.
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- 1973-1975 ROTH, E., Dr.
Commissariat à l'Énergie Atomique, Centre d'Études
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BP 2, F-91 Gif-sur-Yvette (France)
- 1973-1975 TAL'ROSE, V. I., Prof.
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- 1973-1975 TATEMATSU, A., Prof.
Faculty of Pharmacy, Meijo University
Showa-ku, Nagoya 468 (Japan)

I.6 COMMISSION ON COLLOID AND SURFACE CHEMISTRY

(Established 1961)

Titular Members

Chairman

- 1969–1977 MYSELS, K. J., Dr.
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Vice-Chairman

- 1967–1975 BRUNAUER, S., Prof.
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Secretary

- 1967–1975 VAN OLPHEN, H., Prof.
Division of Chemistry and Chemical Technology
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Members

- 1969–1977 BURWELL, JR., R. L., Prof.
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- 1969–1977 HAUL, R., Prof.
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- 1969–1977 KAZANSKY, V. B., Dr.
N D Zelinsky Institute of Organic Chemistry, Academy of
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Leninskii Prospect 47, Moscow V-334 (USSR)
- 1971–1975 KEMBALL, C., Prof.
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- 1967–1975 SCHAY, G., Prof.
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Associate Members

- 1969–1975 BARRER, R. M., Prof.
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- 1969–1975 FRIBERG, S., Dr.
Swedish Institute for Surface Chemistry
Drottning Kristinas Väg 47, S-114 28 Stockholm (Sweden)

- 1971-1975 GERMAIN, J. E., Prof.
École Supérieure de Chimie Industrielle, Université de Lyon
43 Boulevard du 11 Novembre 1918, F-69 Villeurbanne (France)
- 1969-1975 KISELEV, A. V., Prof.
Institute of Physical Chemistry, Academy of Sciences of USSR
Leninskii Prospect 14, Moscow V-71 (USSR)
- 1973-1975 LYKLEMA, J., Prof.
Laboratory for Physical and Colloid Chemistry, State
Agricultural University
6 De Dreijen, Wageningen (Netherlands)
- 1967-1975 SCHEUDKO, A., Prof.
Institute of Physical Chemistry, Bulgarian Academy of Sciences
Sofia 13 (Bulgaria)
- 1969-1975 SCHUIT, G. A., Prof.
Technische Hogeschool
Eindhoven (Netherlands)
- 1971-1975 TAMARU, K., Prof.
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National Representatives

- Japan*
1972- MORIKAWA, K., Dr.
Japan Gasoline Co. Ltd.
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- United Kingdom*
1971- RIDEAL, Sir ERIC
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South Kensington, London SW7 2AY (UK)

II INORGANIC CHEMISTRY DIVISION

(Established 1949)

DIVISION COMMITTEE

President

- 1959–1977 GUTMANN, V., Prof.
Institut für Anorganische Chemie der Technischen Hochschule
Wien
Getreidemarkt 9, A-1060 Wien (Austria)
(TEL: 571656)

Vice-President

- 1969–1977 MALATESTA, L., Prof.
Istituto di Chimica Generale dell'Università di Milano
Via G. Venezian 21, I-20133 Milano (Italy)
(TEL: 230841)

Secretary

- 1971–1977 VLČEK, A. A., Prof.
Ústav Fyzikální Chemie a Elektrochemie J Heyrovského
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Vlašská 9, CS-118 40 Praha 1 (Czechoslovakia)
(TEL: 534150)

Members

- 1973–1977 BAGNALL, K. W., Prof.
Department of Chemistry, University of Manchester
Manchester M13 9PL (UK)
- 1965–1975 COLLONGUES, R., Prof.
Chimie Minérale Appliquée, École Nationale Supérieure de
Chimie, Université de Paris VI
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- 1973–1977 FERNELIUS, W. C., Prof.
Department of Chemistry, University of South Florida
Tampa, Florida 33620 (USA)
- 1973–1977 FLUCK, E., Prof.
Institut für Anorganische Chemie der Universität Stuttgart
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Germany)
- 1971–1975 MAGNÉLI, A., Prof.
Institutionen för Oorganisk och Fysikalisk Kemi, Stockholms
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POB 6801, S-113 86 Stockholm 6 (Sweden)
- 1971–1975 SWINARSKI, A., Prof.
Instytut Chemii, Uniwersytet Mikołaja Kopernika
Ul. Grudziądzka 7, Toruń (Poland)
- 1971–1975 YAMASAKI, K., Prof.
Department of Chemistry, Faculty of Science, Nagoya
University
Chikusa-ku, Nagoya 464 (Japan)

11.1 COMMISSION ON ATOMIC WEIGHTS

(Established 1930)

Titular Members

Chairman

- 1963–1975 GREENWOOD, N. N., Prof.
Department of Inorganic and Structural Chemistry, University
of Leeds
Leeds LS2 9JT (UK)
(TEL: 0532 31751)

Secretary

- 1967–1975 PEISER, H. S., Mr.
Office of International Relations, National Bureau of Standards
US Department of Commerce
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Members

- 1973–1977 DE BIÈVRE, P., Dr.
Bureau Central de Mesures Nucléaires, Commission des
Communautés Européennes
B-2440 Geel (Belgium)
- 1967–1975 FUJIWARA, S., Prof.
Department of Chemistry, University of Tokyo
3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)
- 1973–1977 HOLDEN, N. E., Dr.
Knolls Atomic Power Laboratory
1 River Road, POB 1072, Schenectady, New York 12301 (USA)
- 1971–1975 JOHNSON, W. H., Prof.
School of Physics and Astronomy, University of Minnesota
Minneapolis, Minnesota 55455 (USA)
- 1971–1975 MEINKE, W. W., Dr.
KMS Fusion Inc.
POB 1567, Ann Arbor, Michigan 48106 (USA)
- 1969–1977 ROTH, E., Prof.
Commissariat à l'Énergie Atomique, Centre d'Études
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BP 2, F-91 Gif-sur-Yvette (France)

Associate Members

- 1973–1975 CAMERON, A. E., Dr.
114 W Malta Road, Oak Ridge, Tennessee 37830 (USA)
- 1967–1975 FLEROV, G. N., Prof.
Joint Institute for Nuclear Research
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- 1973-1975 MARTIN, R. L., Prof.
Research School of Chemistry, Australian National University
POB 4, Canberra, ACT (Australia 2600)
- 1973-1975 SAITO, N., Prof.
Department of Chemistry, Faculty of Science, University
of Tokyo
3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)
- 1971-1975 THODE, H. G., Prof.
Nuclear Research Building, Department of Chemistry
McMaster University
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- 1971-1975 WAPSTRA, A. H., Prof.
Instituut voor Kernfysisch Onderzoek
Ooster Ringdijk 18 a, Amsterdam O (Netherlands)

11.2 COMMISSION ON NOMENCLATURE OF INORGANIC CHEMISTRY

(Established 1921)

Titular Members

Chairman

- 1963–1975 FERNELIUS, W. C., Prof.
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Secretary

- 1973–1977 MINGOS, D. M. P., Dr.
Department of Chemistry, Queen Mary College
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Members

- 1967–1975 ADAMS, R. M., Prof.
Geneva College
Beaver Falls, Pennsylvania 15010 (USA)
- 1971–1975 BERTELLO, L. F., Prof.
Perú 420, Accassuso, Buenos Aires (Argentina)
- 1971–1975 BUSCHBECK, K. CH., Dr.
Gmelin-Institut
Carl Bosch-Haus, Varrentrappstrasse 40–42, D-6000
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- 1971–1975 JEANNIN Y., Prof.
UER de Chimie Inorganique, Université Paul Sabatier
38 Rue des Trente Six Ponts, F-31400 Toulouse Cedex 077
(France)
- 1973–1977 LEIGH, G. J., Dr.
Agricultural Research Council Unit of Nitrogen Fixation
University of Sussex
Brighton BN1 9QJ (UK)
- 1971–1975 MYASOEDOV, B., Dr.
Radiochemical Laboratory, V I Vernadskii Institute of
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Associate Members

- 1973–1975 CHATT, J., Prof.
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- 1969–1975 ERDEY-GRÚZ, T., Prof.
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- 1973–1975 JENSEN, K. A., Prof.
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- 1969–1975 POWELL, W. H., Dr.
Chemical Abstracts Service, Ohio State University
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- 1973–1975 RIESS, J., Prof.
Laboratoire de Chimie Minérale et Structurale, Faculté
des Sciences, Université de Nice
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- 1971–1975 SCHÄFFER, C., Dr.
Kemisk Laboratorium II, H.C. Ørsted Institutet
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- 1969–1975 VLČEK, A. A., Prof.
Ústav Fyzikální Chemie e Elektrochemie J Heyrovského
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Vlašská 9, CS-118 40 Praha 1 (Czechoslovakia)
- 1969–1975 YAMASAKI, K., Prof.
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11.2.1 SUB-COMMISSION ON ORGANIC DERIVATIVES OF THE ELEMENTS

(Established 1960)

Chairman

- 1961–1975 CHATT, J., Prof.
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Members

- 1972–1975 CROSS, L. C., Dr.
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- 1974–1975 FERNELIUS, W. C., Prof.
Department of Chemistry, University of South Florida
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- 1965–1975 LOENING, K. L., Dr.
Chemical Abstracts Service, Ohio State University
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- 1961–1975 LOZAC'H, N., Prof.
École Nationale Supérieure de Chimie, Université de Caen
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- 1974–1975 MINGOS, D. M. P., Dr.
Department of Chemistry, Queen Mary College
Mile End Road, London E1 4NS

11.3 COMMISSION ON HIGH TEMPERATURES AND REFRACTORY MATERIALS

(Established 1951)

Titular Members

Chairman

- 1969–1977 ALCOCK, C. B., Prof.
Department of Metallurgy and Materials Science, University of
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Secretary

- 1969–1977 RIECK, G. D., Prof.
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Members

- 1969–1977 FITZER, E., Prof.
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- 1973–1977 FOEX, M., Prof.
Laboratoire des Ultra-Réfractaires du Centre National de la
Recherche Scientifique
BP 5, Odeillo, F-66120 Font Romeu (France)
- 1973–1977 HLAVÁČ, J., Dr.
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Technologické v Praze
Suchbátarova 5, CS-166 28 Praha 6-Dejvice (Czechoslovakia)
- 1973–1977 KUBASCHEWSKI, O., Prof.
Institut für Theoretische Hüttenkunde, Rheinisch-Westfälische
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- 1973–1977 DE MARIA, G., Prof.
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- 1973–1977 STEELE, B. C. H., Dr.
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Associate Members

- 1973–1975 AMATO, U., Dr.
Centro Ricerche Fiat
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- 1965–1975 CABANNES, F., Prof.
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du Centre National de la Recherche Scientifique
F-45045 Orleans, La Source (France)
- 1973–1975 GILLES, P. W., Prof.
Department of Chemistry, University of Kansas
Lawrence, Kansas 66044 (USA)

- 1973–1975 HORTON, W. S., Dr.
Inorganic Materials Division, National Bureau of Standards
US Department of Commerce
Washington, DC 20234 (USA)
- 1969–1975 MI, T., Prof.
Department of Mechanical Engineering, Nagoya University
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- 1969–1975 MOTZFELDT, K., Prof.
Institut for Silikat- og Høytemperaturkjemi, Norges Tekniske
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N-7034 Trondheim (Norway)
- 1969–1975 NOWOTNY, H., Prof.
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- 1973–1975 OHSE, R. W., Dr.
Europäisches Institut für Transurane, Kommission der Euro-
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Germany)

National Representatives

- Arab Republic of Egypt* HUSSEIN, M. K., Prof.
Academy of Scientific Research and Technology
101 Kasr El Eini Street, Cairo
- Australia* MCCARTNEY, E. R., Dr.
1969– Department of Ceramic Engineering, University of New South
Wales
POB 1, Kensington, New South Wales 2033
- Belgium* DROWART, J., Prof.
1969– Laboratoire de Chimie Physique Moléculaire, Université Libre
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50 Avenue F D Roosevelt, B-1050 Bruxelles
- France* COLLONGUES, R., Prof.
1974– Chimie Minérale Appliquée, École Nationale Supérieure de
Chimie, Université de Paris VI
11 Rue Pierre et Marie Curie, F-75231 Paris Cedex 05
- India* ATMA RAM, Dr.
1970– Indian National Science Academy
Bahadur Shah Zafar Marg, New Delhi-1
- Italy* SERSALE, R., Prof.
1973– Istituto di Chimica Applicata, Università Degli Studi di Napoli
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- Poland* MROWEC, S., Prof.
1970– Instytut Chemia Ciała Stałego, Akademia Górniczo-Hutnicza
im Stanisława Staszica w Krakowie
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- Sweden* MAGNÉLI, A., Prof.
1969– Institutionen för Organisk och Fysikalisk Kemi, Stockholms
Universitet
POB 6801, S-113 86 Stockholm 6
- United States of America* CUBICCIOTTI, D. D., Dr.
1970– Vallecitos Nuclear Center, General Electric Co.
Pleasanton, California 94566

III ORGANIC CHEMISTRY DIVISION

(Established 1949)

DIVISION COMMITTEE

President

- 1962-1975 KJÆR, A., Prof.
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Past-President

- 1961-1975 OURISSON, G., Prof.
Institut de Chimie, Université Louis Pasteur Strasbourg
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(TEL: 88 363002)

Vice-President

- 1965-1975 ZOLLINGER, H., Prof.
Technisch-Chemisches Laboratorium der Eidgenössischen
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Secretary

- 1973-1975 YATES, P., Prof.
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Members

- 1973-1977 BOEKELHEIDE, V. C., Prof.
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- 1973-1977 ITÔ, S., Prof.
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Aza Aoba, Aramaki, Sendai 980 (Japan)
- 1971-1975 OVCHINNIKOV, YU. A., Prof.
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Ul. Vavilova 32, Moscow V-312 (USSR)
- 1973-1977 TOMKO, J., Prof.
Pharmaceutical Faculty, J A Comenius University
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- 1971-1975 WILKE, G., Prof.
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Coopted Members

- 1971- HEUSLER, K., Dr.
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CH-4002 Basel (Switzerland)
- 1971- MATHIEU, J., Prof.
Centre de Recherches Roussel Uclaf
102 Route de Noisy, F-93230 Romainville (France)
- 1971- SIMMONS, H. E., Dr.
Central Research Department, Experimental Station
E I du Pont de Nemours and Co. Inc.
Wilmington, Delaware 19898 (USA)

III.I COMMISSION ON NOMENCLATURE OF ORGANIC CHEMISTRY

(Established 1921)

Titular Members

Chairman

- 1953–1975 LOZACH, N., Prof.
École Nationale Supérieure de Chimie, Université de Caen
5 Avenue d'Edimbourg, F-14032 Caen (France)
(TEL: 31 815714)

Secretary

- 1968–1975 KLESNEY, S. P., Mr.
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Midland, Michigan 48640 (USA)
(TEL: 517 636 3754)

Members

- 1971–1975 BLÁHA, K., Dr.
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- 1965–1975 CROSS, L. C., Dr.
Chemical Society
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- 1973–1977 GRÜNEWALD, H., Dr.
Gesellschaft Deutscher Chemiker
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- 1971–1975 KLYNE, W., Prof.
Department of Chemistry, Westfield College
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- 1965–1975 LOENING, K. L., Dr.
Chemical Abstracts Service, Ohio State University
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- 1967–1975 RIGAUDY, J., Prof.
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Physique et de Chimie Industrielle, Université de Paris VI
10 Rue Vauquelin, F-75 Paris 5^e (France)

Associate Members

- 1971–1975 HIRAYAMA, K., Dr.
Research Laboratory, Fuji Photo Film Co. Ltd.
Minamiashigara (near Odawara), Kanagawa-ken 250-01 (Japan)
- 1973–1975 VEIBEL, S., Prof.
Organisk-Kemisk Laboratorium, Danmarks Tekniske Højskole
Bygning 201, DK-2800 Lyngby (Denmark)
- 1972–1975 VÖGTLE, F., Prof.
Institut für Organische Chemie der Universität Würzburg
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III.2 COMMISSION ON PHYSICAL ORGANIC CHEMISTRY

(Established 1973)

Titular Members

Chairman

- 1973–1977 ZOLLINGER, H., Prof.
Technisch-Chemisches Laboratorium der Eidgenössischen
Technischen Hochschule
Universitätstrasse 6, CH-8006 Zürich (Switzerland)
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Secretary

- 1973–1977 PENTON, J. R., Dr.
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Technischen Hochschule
Universitätstrasse 6, CH-8006 Zürich (Switzerland)

Members

- 1973–1977 BUNNETT, J. F., Prof.
Division of Natural Sciences-II, University of California
Santa Cruz, California 95064 (USA)
- 1973–1977 GOLD, V., Prof.
Department of Chemistry, King's College
Strand, London WC2R 2LS (UK)
- 1973–1977 RÜCHARDT, CH., Prof.
Chemisches Laboratorium der Universität Freiburg i. Br.
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Germany)
- 1973–1977 STREITWIESER, JR., A., Prof.
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- 1973–1977 TOULLEC, J., Dr.
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1 Rue Guy de la Brosse, F-75005 Paris Cedex 05 (France)

III.3 COMMISSION ON ORGANIC PHOTOCHEMISTRY

(Established 1969)

Titular Members

Chairman

- 1971–1975 CHAPMAN, O. L., Prof.
Department of Chemistry, Iowa State University
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Secretary

- 1971–1975 SCHAFFNER, K., Prof.
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Members

- 1970–1977 HOYTINK, G. J., Prof.
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Sheffield S3 7HF (UK)
- 1973–1977 LAMOLA, A. A., Dr.
Bell Telephone Laboratories Inc.
600 Mountain Avenue, Murray Hill, New Jersey 07974 (USA)
- 1973–1977 MUKAI, T., Prof.
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Aza Aoba, Aramaki, Sendai 980 (Japan)
- 1969–1977 QUINKERT, G., Prof.
Institut für Organische Chemie der Johann Wolfgang Goethe
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National Representative

- Arab Republic of Egypt* OSMAN, A. M., Prof.
University of Assiut, Assiut
1973–

III.4 SECTION ON MEDICINAL CHEMISTRY

(Established 1969)

Titular Members

Chairman

- 1969–1977 ARIËNS, E. J., Prof.
Farmacologisch Laboratorium, Faculteit der Geneeskunde
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“Heyendaal” Geert Grooteplein Noord 21, Nijmegen
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Secretary

- 1969–1977 RACHLIN, A. I., Dr.
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- 1969–1975 ALBERT, A., Prof.
Research School of Chemistry, Australian National University
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- 1969–1975 CAMPAIGNE, E., Prof.
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Bloomington, Indiana 47401 (USA)
- 1973–1977 HUMBER, L. G., Dr.
Ayerst Laboratories, Division of Ayerst, McKenna &
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POB 6115, Montreal 101, Quebec (Canada)
- 1971–1975 PROTIVA, M., Dr.
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Kouřimská 17, CS-130 00 Praha 3-Vinohrady (Czechoslovakia)
- 1969–1975 SENSI, P., Prof.
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- 1973–1977 THUILLIER, J., Dr.
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Associate Members

- 1971–1975 BAN, Y., Prof.
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- 1973–1975 BLOOM, B., Dr.
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- 1971–1975 CAVALLA, J. F., Dr.
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- 1973–1975 MARTIN, F., Dr.
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- 1971–1975 MUTSCHLER, E., Prof.
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- 1971–1975 NITYA ANAND, Dr.
Division of Medicinal Chemistry, Central Drug Research
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- 1973–1975 PRATESI, P., Prof.
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- 1973–1975 SAREL, S., Prof.
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POB 12065, Jerusalem (Israel)

Representative of IUB

- 1971–
HOFFMANN-OSTENHOF, O., Prof.
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Währingerstrasse 38, A-1090 Wien (Austria)

IV **MACROMOLECULAR DIVISION**

(Established 1967)

DIVISION COMMITTEE

President

- 1967–1975 BENOIT, H., Prof.
Centre de Recherches sur les Macromolécules du
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6 Rue Boussingault, F-67083 Strasbourg (France)
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Past-President

- 1967–1975 WICHTERLE, O., Prof.
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Vice-President

- 1967–1975 OVERBERGER, C. G., Prof.
4080 Administration Building, University of Michigan
Ann Arbor, Michigan 48104 (USA)
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Secretary

- 1967–1975 SMETS, G., Prof.
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(TEL: 016 35821)

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- 1971–1975 BOYER, R. F., Dr.
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- 1971–1975 FISCHER, E. W., Prof.
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- 1971–1975 IWAKURA, Y., Prof.
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- 1971–1975 KABANOV, V. A., Prof.
Macromolecular Department, Lomonosov Moscow State
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- 1971–1975 SAUNDERS, D. W., Prof.
Department of Materials, Cranfield Institute of Technology
Cranfield, Bedford (UK)
- 1971–1975 DE VRIES, A. J., Dr.
Centre de Recherches de la Croix-de-Berny, Rhône-Progil SA
182-184 Avenue Aristide Briand, F-92160 Antony (Seine)
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Coopted Members

- 1973- BARRETT, J. W., Dr.
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Monsanto House, 10-18 Victoria Street, London SW1H 0NQ
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- 1971- CHERDRON, H., Dr.
Farbwerke Hoechst AG, Kunststoff-Forschung
Postfach 800320, D-6230 Frankfurt/Main 80 (Federal
Republic of Germany)
- 1971- EISENBERG, H., Dr.
Weizmann Institute of Science
Rehovot (Israel)
- 1973- FINK-JENSEN, P. H., Mr.
A/S Sadolin og Holmblad
Holmbladsgade 70, DK-2300 København S (Denmark)
- 1971- HOFFMAN, J. D., Dr.
National Bureau of Standards, US Department of Commerce
Washington, DC 20234 (USA)
- 1969- KLINE, G. M., Dr.
331 South Palmway, Lake Worth, Florida 33460 (USA)
- 1969- MELVILLE, Sir HARRY
Queen Mary College
Mile End Road, London E1 4NS (UK)
- 1971- OKAMURA, S., Prof.
Department of Polymer Chemistry, Kyoto University
Yoshida-machi, Sakyo-ku, Kyoto (Japan)
- 1971- STAVERMAN, A. J., Prof.
Gorlaeus Laboratoria der Rijksuniversiteit
Wassenaarseweg, POB 75, Leiden (Netherlands)

National Representatives

- Australia*
1968- SOLOMON, D. H., Dr.
Division of Applied Chemistry, Commonwealth Scientific and
Industrial Research Organization
POB 4331, Melbourne, Victoria 3001
- Austria*
1970- BREITENBACH, J. W., Prof.
Institut für Physikalische Chemie der Universität Wien
Währingerstrasse 42, A-1090 Wien IX
- Bulgaria*
1968- PANAYOTOV, I. M., Prof.
Institute of Organic Chemistry, Bulgarian Academy of Sciences
Sofia 13
- Czechoslovakia*
1974- KÁLAL, J., Prof.
Institute of Macromolecular Chemistry, Československá
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Petřiny 1888, CS-162 06 Praha 616
- Denmark*
1968- BJÖRKMAN, A., Prof.
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- Federal Republic of Germany* ENGEL, F., Dr.
1968– Chemische Werke Hüls AG
D-4370 Marl/Westfahlen
- Finland* LINDBERG, J. J., Prof.
1971– Department of Wood and Polymer Chemistry, University of Helsinki
Malminkatu 20, SF-00100 Helsinki 10
- France* SIGWALT, P., Prof.
1972– Laboratoire de Chimie Macromoléculaire, Université de Paris VI
11 Quai St-Bernard, F-75 Paris 5°
- Hungary* TÜDOS, F., Prof.
1968– Central Research Institute for Chemistry, Hungarian Academy of Sciences
Pusztaszeri Út 57-69, H-1025 Budapest II
- Israel* SILBERBERG, A., Prof.
1968– Weizmann Institute of Science
Rehovot
- Netherlands* MANDEL, M., Prof.
1971– Gorlaeus Laboratoria der Rijksuniversiteit
Wassenaarsweg, POB 75, Leiden
- Norway* UGELSTAD, J., Prof.
1968– Institute of Industrial Chemistry, Universitetet i Trondheim
N-7034 Trondheim-NTH
- Poland* TURSKA, E., Prof.
1968– Department of Physical Chemistry of High Polymers, Polytechnic Institute of Lodz
Zwirki 36, Lodz
- Republic of South Africa* JOUBERT, F. J., Dr.
1968– c/o IUPAC National Committee, Council for Scientific and Industrial Research
POB 395, Pretoria
- Romania* SIMIONESCU, C., Prof.
1969– Akademia Republicii Socialiste România
Str. Universitatii N 16, Iași
- Sweden* RÅNBY, B., Prof.
1969– Department of Polymer Technology, Royal Institute of Technology
S-100 44 Stockholm 70
- United Kingdom* BAMFORD, C. H., Prof.
1973– Donnan Laboratories, Department of Inorganic, Physical, and Industrial Chemistry, University of Liverpool
Grove Street, POB 147, Liverpool L69 3BX
- United States of America* BAILEY, W. J., Prof.
1968– Department of Chemistry, University of Maryland
College Park, Maryland 20742

Representative of IUPAB

- 1969– SCHERAGA, H. A., Prof.
Department of Chemistry, Cornell University
Ithaca, New York 14850 (USA)

Representative of IUPAP

1973—

BECKER, G. W., Prof.

Bundesanstalt für Materialprüfung

Unter den Eichen 87, D-1000 Berlin 45 (Federal Republic of Germany)

IV.1 COMMISSION ON MACROMOLECULAR NOMENCLATURE

(Established 1968)

Titular Members

Chairman

- 1968-1975 LOENING, K. L., Dr.
Chemical Abstracts Service, Ohio State University
POB 1378, Columbus, Ohio 43210 (USA)
(TEL: 614 421 6940)

Secretary

- 1968-1975 CROSS, L. C., Dr.
Chemical Society
Burlington House, Piccadilly, London W1V 0BN (UK)
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Members

- 1968-1975 CORRADINI, P., Prof.
Istituto Chimico, Università di Napoli
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- 1968-1975 Fox, R. B., Dr.
Code 6120, US Naval Research Laboratory, Department of
the Navy
Washington, DC 20390 (USA)
- 1971-1975 PLATÉ, N. A., Prof.
Institute of Petrochemical Synthesis, Academy of Sciences
of USSR
Leninskii Prospect 29, Moscow V-71 (USSR)
- 1971-1975 RING, W., Dr.
Chemische Werke Hüls AG
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Republic of Germany)
- 1968-1975 SMETS, G., Prof.
Laboratorium voor Macromoleculaire en Organische Scheikunde
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- 1968-1975 TSURUTA, T., Prof.
Department of Synthetic Chemistry, Faculty of Engineering
University of Tokyo
3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)

IV.2 COMMISSION ON POLYMER CHARACTERIZATION AND PROPERTIES

Members

(to be appointed)

V ANALYTICAL CHEMISTRY DIVISION

(Established 1949)

DIVISION COMMITTEE

President

- 1969–1977 TANAKA, N., Prof.
Department of Chemistry, Faculty of Science, Tohoku
University
Aza Aoba, Aramaki, Sendai 980 (Japan)
(TEL: 0222 22 1800)

Past-President

- 1965–1975 KEMULA, W. Prof.
Instytut Chemii Fizycznej, Polska Akademii Nauk
Ul. Kasprzaka 44-52, PL 01-224 Warszawa (Poland)
(TEL: 327269)

Secretary

- 1967–1975 FENNELL, R. W., Mr.
Materials Department, Royal Aircraft Establishment
Farnborough, Hampshire GU14 6TD (UK)
(TEL: 0252 24461. TELEX: 85134)

Members

- 1973–1977 HUME, D. N., Prof.
Department of Chemistry, Massachusetts Institute of Technology
Cambridge, Massachusetts 02139 (USA)
- 1973–1977 KAISER, H., Prof.
Institut für Spektrochemie und Angewandte Spektroskopie
Postfach 778, Bunsen-Kirchoff-Strasse 11, D-4600
Dortmund (Federal Republic of Germany)
- 1971–1975 KOLTHOFF, I. M., Prof.
Department of Chemistry, University of Minnesota
Minneapolis, Minnesota 55455 (USA)
- 1971–1975 SAMUELSON, O., Prof.
Institutionen för Teknisk Kemi, Chalmers Tekniska Högskola
Gibraltargatan 5A, S-402 20 Göteborg 5 (Sweden)
- 1971–1975 TRÉMILLON, B., Prof.
Laboratoire de Chimie Analytique et d'Electrochimie, École
Nationale Supérieure de Chimie, Université de Paris VI
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- 1971–1975 WEST, T. S., Prof.
Department of Chemistry, Imperial College of
Science and Technology
South Kensington, London SW7 2AY (UK)
- 1971–1975 ZOLOTOV, Yu. A., Prof.
V I Vernadskii Institute of Geochemistry and Analytical
Chemistry, Academy of Sciences of USSR
Vorobyevskoye Chaussée 47-a, SZD-117334 Moscow (USSR)

V.I COMMISSION ON ANALYTICAL REACTIONS AND REAGENTS

(Established 1934)

Titular Members

Chairman

- 1968-1975 BELCHER, R., Prof.
Department of Chemistry, University of Birmingham
POB 363, Birmingham B15 2TT (UK)
(TEL: 021 472 1301)

Secretary

- 1968-1975 PELLERIN, F., Prof.
Hôpital Général Emile Roux, F-95600 Eaubonne (France)
(TEL: 1 959 5520)

Members

- 1971-1975 BARTOS, J., Dr.
Centre de Recherches Roussel Uclaf
102 Route de Noisy, F-93230 Romainville (France)
- 1969-1977 HULANICKI, A., Dr.
Instytut Podstawowych, Problemów Chemii, Wydział Chemii
Uniwersytet Warszawski
Ul. Pasteura 1, PL 02-093 Warszawa (Poland)
- 1971-1975 KAPEL, M., Dr.
Proctor Department of Food and Leather Science, University
of Leeds
Leeds LS2 9JT (UK)
- 1969-1977 REIDINGER, F. J., Mr.
Film Division, Olin Corp.
Pisgah Forest, North Carolina 28768 (USA)
- 1968-1975 SIGGIA, S., Prof.
Department of Chemistry, Commonwealth of Massachusetts
University of Massachusetts
Amherst, Massachusetts 01002 (USA)
- 1970-1974 WEISZ, H., Prof.
Lehrstuhl für Analytische Chemie, Chemisches Laboratorium
der Universität Freiburg i. Br.
Albertstrasse 21, D-7800 Freiburg i. Br. (Federal Republic of
Germany)

Associate Members

- 1970-1975 BURRIEL-MARTI, F., Prof.
Departamento de Química Analítica de la Facultad de Ciencias
Universidad de Madrid
Ciudad Universitaria, Madrid-3 (Spain)
- 1971-1975 DUYCKAERTS, G., Prof.
Institut de Chimie et Métallurgie, Université de Liège
au Sart Tilman
B-4000 Liège (Belgium)

- 1971–1975 HARMELIN, M., Dr.
Centre d'Études de Chimie Métallurgique du Centre
National de la Recherche Scientifique
15 Rue Georges Urbain, F-94400 Vitry-sur-Seine (France)
- 1970–1975 IKEDA, S., Prof.
Department of Analytical Chemistry, Faculty of Science
Osaka University
Machikaneyama, 1,1, Toyonaka, Osaka (Japan)
- 1970–1975 INCZÉDY, J., Prof.
Analitikai Kémia Tanszék, Veszprémi Vegyipári Egyetem
Schönherz Z.u. 12, H-8201 Veszprém (Hungary)
- 1973–1975 LUCENA CONDE, F., Prof.
Departamento de Química Analítica de la Facultad de Ciencias
Universidad de Salamanca
Salamanca (Spain)
- 1971–1975 PESEZ, M., Dr.
Centre de Recherches Roussel Uclaf
102 Route de Noisy, F-93230 Romainville (France)
- 1973–1975 STEPHEN, W. I., Dr.
Department of Chemistry, University of Birmingham
POB 363, Birmingham B15 2TT (UK)

V.2

COMMISSION ON MICROCHEMICAL TECHNIQUES AND TRACE ANALYSIS

(Established in its present form 1967)

Titular Members

Chairman

- 1967-1975 KOCH, O. G., Dr.
Chemisches Laboratorium, Neunkircher Eisenwerk AG
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of Germany)
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Secretary

- 1971-1975 PÍNTA, M., Dr.
Laboratoire de Spectrographie, Office de la Recherche
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(TEL: 847 5295)

Members

- 1969-1975 CHENG, K. L., Prof.
Department of Chemistry, University of Missouri
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- 1971-1975 GOMIŠČEK, S., Prof.
Faculty of Natural Sciences and Technology, University of
Ljubljana
Murnikova 6, YU-61000 Ljubljana (Yugoslavia)
- 1971-1975 MACDONALD, A. M. G., Dr.
Department of Chemistry, University of Birmingham
POB 363, Birmingham B15 2TT (UK)
- 1973-1977 MIZUIKE, A., Prof.
Faculty of Engineering, Nagoya University
Chikusa-ku, Nagoya 464 (Japan)
- 1971-1975 MORRISON, G. H., Prof.
Department of Chemistry, Cornell University
Ithaca, New York 14850 (USA)
- 1973-1977 TERENT'EVA, E. A., Dr.
Institute of Organoelement Compounds, Academy of Sciences
of USSR
Ul. Vavilova 28, SZD-117312 Moscow (USSR)

Associate Members

- 1973-1975 GEL'MAN, N. E., Dr.
Institute of Organoelement Compounds, Academy of Sciences
of USSR
Ul. Vavilova 28, SZD-117312 Moscow (USSR)
- 1971-1975 GRASSERBAUER, M., Dr.
Institut für Analytische Chemie und Mikrochemie der
Technischen Hochschule Wien
Getreidemarkt 9, A-1060 Wien (Austria)

- 1973-1975 INGRAM, G., Dr.
Department of Chemistry and Geology, Portsmouth Polytechnic
Burnaby Road, Portsmouth PO1 3QL (UK)
- 1971-1975 LÉVY, R., Dr.
Service Central de Microanalyse du Centre National
de la Recherche Scientifique
2 Rue Henri Dunant, F-94320 Thiais (France)
- 1971-1975 MINCZEWSKI, J., Prof.
Instytut Badan Jadrowych
Świerk-Otwock (Poland)

V.3

COMMISSION ON ANALYTICAL NOMENCLATURE

(Established in its present form 1959)

Titular Members

Chairman

- 1965–1975 IRVING, H. M. N. H., Prof.
School of Chemistry, University of Leeds
Leeds LS2 9JT (UK)
(TEL: 0532 31751)

Secretary

- 1969–1977 ZETTLER, H., Dr.
Norddeutsche Affinerie
Postfach 67, Alsterterrasse 2, D-2000 Hamburg 36 (Federal
Republic of Germany)
(TEL: 040 7883607. TELEX: 0214081)

Members

- 1971–1975 BAUDIN, G., Dr.
Commisariat a l'Énergie Atomique, Centre d'Études Nucléaires
BP 6, F-92260 Fontenay-aux-Roses (France)
- 1973–1977 FREISER, H., Prof.
Department of Chemistry, University of Arizona
Tucson, Arizona 85721 (USA)
- 1973–1977 GUILBAULT, G. G., Prof.
Department of Chemistry, Louisiana State University
Lake Front, New Orleans, Louisiana 70122 (USA)
- 1969–1977 MENIS, O., Dr.
Analytical Chemistry Division, National Bureau of Standards
US Department of Commerce
Washington, DC 20234 (USA)
- 1973–1977 RICE, N. M., Dr.
Department of Mining and Mineral Sciences, University
of Leeds
Leeds LS2 9JT (UK)
- 1971–1975 ROBERTSON, A. J. B., Prof.
Department of Chemistry, King's College
Strand, London WC2R 2LS (UK)

Associate Members

- 1971–1975 DOCHERTY, A. C., Dr.
Agricultural Division, Imperial Chemical Industries Ltd.
POB 8, Billingham, Teesside TS23 1LE (UK)
- 1973–1975 FISCHER, W., Prof.
Lugustrasse 14, D-7800 Freiburg i.Br. (Federal Republic of
Germany)
- 1971–1975 KAISER, H., Prof.
Institut für Spektrochemie und Angewandte Spektroskopie
Postfach 778, Bunsen-Kirchhoff-Strasse 11, D-4600
Dortmund (Federal Republic of Germany)

- 1971–1975 KIRKBRIGHT, G. F., Dr.
Department of Chemistry, Imperial College of Science and
Technology
South Kensington, London SW7 2AY (UK)
- 1971–1975 SAMUELSON, O., Prof.
Institutionen för Teknisk Kemi, Chalmers Tekniska Högskola
Gibraltargatan 5A, Fack, S-402 20 Göteborg 5 (Sweden)
- 1971–1975 SVEHLA, G., Dr.
Department of Chemistry, Queen's University of Belfast
Belfast BT9 5AG, Northern Ireland (UK)
- 1973–1975 TÖLG, G., Prof.
Laboratorium für Reinstoffe, Max-Planck Institut für
Metallforschung
Katharinenstrasse 17, D-7070 Schwäbisch Gmünd (Federal
Republic of Germany)
- 1973–1975 WEST, T. S., Prof.
Department of Chemistry, Imperial College of Science and
Technology
South Kensington, London SW7 2AY (UK)

National Representative

- Arab Republic of Egypt* TAWFIK, H. A., Prof.
1973– Faculty of Pharmacy, Alexandria University
Alexandria

V.4

COMMISSION ON SPECTROCHEMICAL AND OTHER OPTICAL PROCEDURES FOR ANALYSIS

(Established in its present form 1959)

Titular Members

Chairman

- 1959–1975 FASSEL, V. A., Prof.
Ames Laboratory, US Atomic Energy Commission
Iowa State University
Ames, Iowa 50010 (USA)
(TEL: 515 294 2112)

Secretary

- 1971–1975 SCRIBNER, B. F., Mr.
National Bureau of Standards, US Department of Commerce
Washington, DC 20234 (USA)
(TEL: 301 921 2128)

Members

- 1967–1975 ALKEMADE, C. TH. J., Prof.
Fysisch Laboratorium, Rijksuniversiteit Utrecht
Sorbonnelaan 4, Utrecht (Uithof) (Netherlands)
- 1967–1975 BIRKS, L. S., Mr.
Code 6680, US Naval Research Laboratory, Department of
the Navy
Washington, DC 20390 (USA)
- 1969–1975 MENZIES, A. C., Dr.
60 Crown Street, Harrow-on-the-Hill HA2 0HR, Middlesex (UK)
- 1967–1975 PLŠKO, E., Dr.
Geologický Ústav Univerzity Komenského
Zadunajská 15, CS-811 00 Bratislava (Czechoslovakia)
- 1971–1975 ROBIN, J. P., Prof.
Département de Chimie Industrielle, Institut National des
Sciences Appliquées de Lyon
20 Avenue Albert Einstein, F-69621 Villeurbanne (France)
- 1971–1975 WINEFORDNER, J. D., Prof.
Department of Chemistry, University of Florida
Gainesville, Florida 32611 (USA)

Associate Members

- 1972–1975 JENKINS, R., Mr.
Philips Electronics Instruments Inc.
750 Fulton Street, Mount Vernon, New York (USA)
- 1971–1975 KAISER, H., Prof.
Institut für Spektrochemie und Angewandte Spektroskopie
Postfach 778, Bunsen-Kirchhoff-Strasse 11, D-4600
Dortmund (Federal Republic of Germany)
- 1971–1975 KVALHEIM, A., Mr.
Chemistry Division, Norges Geologiske Undersøkelse
POB 3006, Leif Elrikssons Vei 39, N-7001 Trondheim (Norway)

- 1974-1975 MÜLLER, R., Dr.
CIBA-GEIGY AG
CH-4002 Basel (Switzerland)
- 1967-1975 RUBEŠKA, I., Dr.
Ústřední Ústav Geologický
Kostelní 26, Praha 7 (Czechoslovakia)
- 1965-1975 STRASHEIM, A., Dr.
National Physical Research Laboratory, Council for Scientific
and Industrial Research
POB 395, Pretoria (Republic of South Africa)
- 1972-1975 VUKANOVIČ, V., Prof.
Bulevar JNA 2, YU-11000 Beograd (Yugoslavia)
- 1973-1975 WALTERS, J., Prof.
Department of Chemistry, University of Wisconsin
Madison, Wisconsin 53706 (USA)

(Established in its present form 1963)

Titular Members*Chairman*

- 1971-1975 BATES, R. G., Prof.
Department of Chemistry, University of Florida
Gainesville, Florida 32611 (USA)
(TEL: 904 392 0561)

Secretary

- 1971-1975 COETZEE, J. F., Prof.
Department of Chemistry, University of Pittsburgh
Pittsburgh, Pennsylvania 15260 (USA)
(TEL: 412 621 3500)

Members

- 1969-1977 BISHOP, E., Dr.
Department of Chemistry, University of Exeter
Stocker Road, Exeter EX4 4QD, Devon (UK)
- 1971-1975 FUJINAGA, T., Prof.
Department of Chemistry, Faculty of Science, Kyoto University
Sakyo-ku, Kyoto (Japan)
- 1969-1977 GALUS, Z., Prof.
Department of Chemistry, Uniwersytet Warszawski
Ul. Pasteura 1, PL 02-093 Warszawa (Poland)
- 1967-1975 MEITES, L., Prof.
Department of Chemistry, Clarkson College of Technology
Potsdam, New York 13676 (USA)
- 1971-1975 NÜRNBERG, H. W., Prof.
Zentralinstitut für Analytische Chemie der Kernforschungsanlage
Jülich GmbH
Postfach 365, D-5170 Jülich (Federal Republic of Germany)
- 1973-1977 ZUMAN, P., Prof.
Department of Chemistry, Clarkson College of Technology
Potsdam, New York 13676 (USA)

Associate Members

- 1973-1975 BRANICA, M., Prof.
Ruder Bošković Institute
POB 1016, Zagreb (Yugoslavia)
- 1973-1975 CHARLOT, G., Prof.
Laboratoire de Chimie Analytique, École Supérieure de Physique
et de Chimie Industrielle, Université de Paris VI
10 Rue Vauquelin, F-75 Paris 5^e (France)
- 1973-1975 IZUTSU, K., Prof.
Faculty of Science, Shinshu University
3-1-1 Asahi, Matsumoto 390 (Japan)

- 1973–1975 JORDAN, J., Prof.
152 Davey Laboratory, Pennsylvania State University
University Park, Pennsylvania 16802 (USA)
- 1973–1975 MAŠEK, J., Dr.
Ústav Fyzikální Chemie a Elektrochemie J Heyrovského
Československá Akademie Věd
Opletalova 25, CS-110 00 Praha 1-Nové Město (Czechoslovakia)
- 1973–1975 NYGARD, B., Prof.
Department of Chemistry, University of Uppsala
POB 531, S-751 21 Uppsala (Sweden)
- 1971–1975 PUNGOR, E., Prof.
Általános és Analitikai Kémiai Tanszék, Budapesti Műszaki
Egyetem
Gellért Tér 4, Budapest XI (Hungary)
- 1971–1975 TRÉMILLON, B., Prof.
Laboratoire de Chimie Analytique et d'Electrochimie, École
Nationale Supérieure de Chimie, Université de Paris VI
11 Rue Pierre et Marie Curie, F-75231 Paris Cedex 05 (France)

National Representatives

- Australia* PERRIN, D. D., Dr.
1971– Medical Chemistry Group, John Curtin School
of Medical Research, Australian National University
POB 4, Canberra, ACT 2600
- Federal Republic of Germany* KRAFT, G., Dr.
1972– Metallgesellschaft AG
Reuterweg 14, D-6000 Frankfurt/Main
- Japan* TANAKA, N., Prof.
1969– Department of Chemistry, Faculty of Science, Tohoku
University
Aza Aoba, Aramaki, Sendai 980
- Poland* KEMULA, W., Prof.
1969– Institut Chemii Fizycznej, Polska Akademii Nauk
Ul. Kasprzaka 44-52, PL 01-224 Warszawa
- United Kingdom* KANE, P. O., Dr.
1971– Mond Division, Imperial Chemical Industries Ltd.
POB 8, Runcorn, Cheshire

V.6 COMMISSION ON EQUILIBRIUM DATA

(Established 1955)

Titular Members

Chairman

- 1971–1975 NANCOLLAS, G. H., Prof.
Department of Chemistry, State University of New York at
Buffalo
Acheson Hall, Buffalo, New York 14214 (USA)
(TEL: 716 831 3014)

Secretary

- 1973–1977 AHRLAND, S., Dr.
Department of Inorganic and Physical Chemistry, Chemical
Center, University of Lund
POB 740, S-220 07 Lund 7 (Sweden)
(TEL: 046 124600)

Members

- 1973–1977 ANDEREGG, G., Prof.
Laboratorium für Anorganische Chemie der Eidgenössischen
Technischen Hochschule
Universitätstrasse 6, CH-8006 Zürich (Switzerland)
- 1973–1977 FREISER, H., Prof.
Department of Chemistry, University of Arizona
Tucson, Arizona 85721 (USA)
- 1971–1975 HÖGFELDT, E., Dr.
Department of Inorganic Chemistry, Royal Institute of
Technology
S-100 44 Stockholm 70 (Sweden)
- 1969–1977 KERTES, A. S., Prof.
Institute of Chemistry, Hebrew University of Jerusalem
Jerusalem (Israel)
- 1971–1975 PERRIN, D. D., Dr.
Medical Chemistry Group, John Curtin School
of Medical Research, Australian National University
POB 4, Canberra, ACT (Australia 2600)
- 1971–1975 STARÝ, J., Dr.
Katedra Jaderné Chemie, Fakulta Jaderné a Fyzikálné
Inženýrská
Břehova Ul. 7, Praha 1-Staré Město (Czechoslovakia)

Associate Members

- 1973–1975 BECK, M. T., Prof.
Institute of Physical Chemistry, Kossuth Lajos University
H-4010 Debrecen (Hungary)
- 1974–1975 CLIFFORD, A. F., Prof.
Department of Chemistry, Virginia Polytechnic Institute
and State University
Blacksburg, Virginia 24061 (USA)

- 1973-1975 HUME, D. N., Prof.
Department of Chemistry, Massachusetts Institute of Technology
Cambridge, Massachusetts 02139 (USA)
- 1973-1975 MARCUS, Y., Prof.
Institute of Chemistry, Hebrew University of Jerusalem
Jerusalem (Israel)
- 1973-1975 OHTAKI, H., Dr.
Department of Chemistry, Tokyo Institute of Technology
12-1-0 Okayama, 2-chome Meguro-ku, Tokyo 153 (Japan)
- 1973-1975 YOUNG, C. L., Dr.
Department of Chemistry, University of Melbourne
Parkville, Victoria (Australia 3052)
- 1971-1975 ZOLOTOV, YU. A., Prof.
V I Vernadskii Institute of Geochemistry and Analytical
Chemistry, Academy of Sciences of USSR
Vorobyevskoye Chaussée 47-a, Moscow V-334 (USSR)

National Representatives

- Union of Soviet Socialist Republics* YATZIMIRSKII, K. B., Prof.
L V Pisarzhevskii Institute of Physical Chemistry
Academy of Sciences of Ukrainian SSR
1969- Prospect Nauki 97, Kiev 28
- United States of America* MARTELL, A. E., Prof.
Department of Chemistry, Texas A & M University
1969- College Station, Texas 77843

V.6.1 SUB-COMMISSION ON SOLUBILITY DATA

(Established 1973)

Chairman

- 1973–1975 KERTES, A. S., Prof.
Institute of Chemistry, Hebrew University of Jerusalem
Jerusalem (Israel)
(TEL: 02 531 221)

Members

- 1974–1975 CLIFFORD, A. F., Prof.
Department of Chemistry, Virginia Polytechnic Institute
and State University
Blacksburg, Virginia 24061 (USA)
- 1973–1975 KUBASCHEWSKI, O., Prof.
Institut für Theoretische Hüttenkunde, Rheinisch-Westfälische
Technische Hochschule Aachen
Birkenweg 16, D-5100 Aachen (Federal Republic of Germany)
- 1973–1975 NANCOLLAS, G. H., Prof.
Department of Chemistry, State University of New York at
Buffalo
Acheson Hall, Buffalo, New York 14214 (USA)
- 1973–1975 TANANAEV, I. V., Prof.
N S Kurnakov Institute of General and Inorganic Chemistry
Academy of Sciences of USSR
Leninskii Prospect 31, Moscow (USSR)
- 1973–1975 YOUNG, C. L., Dr.
Department of Chemistry, University of Melbourne
Parkville, Victoria (Australia 3052)

Representative of CODATA

- 1974– ELIEZER, I., Prof.
Department of Chemical Physics, Weizmann Institute
of Science
Rehovot (Israel)

Representative of Gmelin Institut

- 1974– LIPPERT, W., Dr.
Gmelin Institut
Carl Bosch-Haus, Varrentrappstrasse 40-42, D-6000
Frankfurt 90 (Federal Republic of Germany)

**V.6.2 SUB-COMMISSION ON COMPILATION OF
STABILITY CONSTANT DATA FOR METAL
COMPLEXES IN SOLUTION**

(Established 1973)

Chairman

- 1973-1975 PERRIN, D. D., Dr.
Medical Chemistry Group, John Curtin School
of Medical Research, Australian National University
POB 4, Canberra, ACT (Australia 2600)

Members

- 1974-1975 DEMPSEY, B., Prof.
Faculty of Military Studies, University of New South
Wales
Duntroon, ACT (Australia 2600)
- 1973-1975 HÖGFELDT, E., Dr.
Department of Inorganic Chemistry, Royal Institute of
Technology
S-100 44 Stockholm 70 (Sweden)
- 1973-1975 OHTAKI, H., Dr.
Department of Chemistry, Tokyo Institute of Technology
12-1-0 Okayama, 2-chome Meguro-ku, Tokyo 153 (Japan)
- 1974-1975 SERJEANT, P., Dr.
Faculty of Military Studies, University of New South
Wales
Duntroon, ACT (Australia 2600)
- 1973-1975 YATZIMIRSKII, K. B., Prof.
L V Piszarzhevskii Institute of Physical Chemistry
Academy of Sciences of Ukrainian SSR
Prospect Nauki 97, Kiev 28 (USSR)

V.7 COMMISSION ON ANALYTICAL RADIO-CHEMISTRY AND NUCLEAR MATERIALS

(Established 1965)

Titular Members

Chairman

- 1965–1975 CRESPI, M. B. A., Dr.
Comisión Nacional de Energía Atómica
Avenida del Libertador 8250, Buenos Aires (Argentina)
(TEL: 707711)

Secretary

- 1971–1975 WHITE, J. C., Dr.
Analytical Chemistry Division, Oak Ridge National
Laboratory
POB X, Oak Ridge, Tennessee 37830 (USA)
(TEL: 615 483 8611)

Members

- 1971–1975 GIRARDI, F., Dr.
Chemistry Division, Commission des Communautés
Européennes—EURATOM
I-21020 Ispra (Varese) (Italy)
- 1973–1977 HOSTE, J., Prof.
Instituut voor Nucleaire Wetenschappen, Rijksuniversiteit-
Ghent
Proeftuinstraat 40, B-9000 Ghent (Belgium)
- 1969–1977 KOSTA, L., Prof.
Oddelek za Kemijo Univerze v Ljubljani
Murnikova 6, POB 537, YU-61001 Ljubljana (Yugoslavia)
- 1971–1975 SAITO, N., Prof.
Department of Chemistry, Faculty of Science, University
of Tokyo
3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)
- 1973–1977 SANKAR DAS, M., Dr.
Analytical Chemistry Division, Bhabha Atomic Research Centre
Trombay, Bombay-400085 (India)
- 1969–1977 WAINERDI, R. E., Prof.
Office of Vice-President for Academic Affairs, Texas A & M
University
College Station, Texas 77843 (USA)

Associate Members

- 1971–1975 COMAR, D., Dr.
Service Hospitalier Frédéric Joliot, Département de Biologie
Centre d'Études Nucléaires
de Saclay
F-91 Orsay (France)
- 1971–1975 COOK, G. B., Dr.
Seibersdorf Laboratory, International Atomic Energy Agency
A-2444 Niederösterreich (Austria)

- 1973-1975 LUX, F., Prof.
Institut für Radiochemie der Technischen Universität München
D-8046 Garching (Federal Republic of Germany)
- 1969-1975 MINCZEWSKI, J., Prof.
Instytut Badán Jadrowych
Świerk-Otwock (Poland)
- 1973-1975 RAFTER, T. A., Dr.
Institute of Nuclear Sciences, Department of Scientific and
Industrial Research
Private Bag, Lower Hutt (New Zealand)
- 1973-1975 SMALES, A. A., Dr.
72 Wolsingham Drive, Stainsby Hill, Old Thornaby, Cleveland
County (UK)
- 1971-1975 STEINNES, E., Dr.
Institutt for Atomenergi
POB 40, N-2007 Kjeller (Norway)

National Representatives

- Hungary* SZABO, E., Dr.
1971- Central Research Institute for Physics, Hungarian Academy of
Sciences
Konkoly-Thege Út, Budapest XII
- Netherlands* DE BRUIN, M., Ir.
1973- Dreeslaan 21, Pijnacker

VI APPLIED CHEMISTRY DIVISION

(Established 1949)

DIVISION COMMITTEE

President

- 1971-1977 EGAN, H., Dr.
Laboratory of the Government Chemist, Department of
Industry
Cornwall House, Stamford Street, London SE1 9NQ (UK)
(TEL: 01 928 7900)

Past-President

- 1967-1977 CAIRNS, R. W., Dr.
American Chemical Society
1155 Sixteenth Street NW, Washington, DC 20036 (USA)
(TEL: 202 872 4455)

Vice-Presidents

- 1973-1977 STOLL, W. G., Dr.
CIBA-GEIGY AG
CH-4002 Basel (Switzerland)
(TEL: 061 325011. TELEX: 62991)
- 1971-1975 SUOMALAINEN, H., Prof.
Finnish State Alcohol Monopoly (Alko)
POB 350, SF-00101 Helsinki 10 (Finland)
(TEL: 642911. TELEX: 12 1045)

Secretary

- 1973-1977 COLLINGS, A. J., Dr.
Unilever Research Laboratory
Colworth House, Sharnbrook, Bedford MK44 1LQ (UK)
(TEL: 0234 55251)

Members

- 1971-1975 CRESPI, G., Prof.
Montecatini-Edison SpA
Largo Donegani 1/2, I-20121 Milano (Italy)
- 1973-1977 EPSTEIN, J. A., Dr.
Dead Sea Works Ltd.
Potash House, POB 75, Beer-Sheba (Israel)
- 1973-1977 LANGLYKKE, A. F., Dr.
American Society for Microbiology
1913 I Street NW, Washington, DC 20006 (USA)
- 1971-1975 MEINKE, W. W., Dr.
KMS Fusion Inc.
POB 1567, Ann Arbor, Michigan 48106 (USA)
- 1971-1975 WEISSERMEL, K., Dr.
Farbwerke Hoechst AG
Postfach 800320, D-6230 Frankfurt/Main 80 (Federal Republic
of Germany)

VI.1 SECTION ON FOOD

(Established 1953)

SECTION COMMITTEE

Titular Members

Chairman

- 1967-1975 MARCUSE, R., Dr.
Svenska Institutet för Konserveringsforskning
Kallëback, Fack, S-400 21 Göteborg 16 (Sweden)
(TEL: 031 400120)

Secretary

- 1971-1975 GUTHENBERG, H., Dr.
Swedish Customs
Fack, S-103 10 Stockholm 2 (Sweden)
(TEL: 08 240000)

Members

- 1971-1975 HAENNI, E. O., Dr.
7907 Glenbrook Road, Bethesda, Maryland 20014 (USA)
- 1969-1977 KOJIMA, K., Dr.
Laboratory for Medicinal Plants, National Institute of
Hygienic Sciences
30, Kasukabe, Kasukabe-shi, Saitama-ken 344 (Japan)
- 1973-1977 NIKONOROW, M., Prof.
Państwowy Zakład Higieny
Ul. Chocimska 24, PL 00-791 Warszawa (Poland)
- 1973-1977 OHNO, K., Dr.
Ajinomoto Co. Inc.
6,1-chome, Kyobashi, Chuo-ku, Tokyo 104 (Japan)
- 1973-1977 TRACEY, M. V., Mr.
Division of Food Research, Commonwealth Scientific and
Industrial Research Organization
POB 52, North Ryde, New South Wales (Australia 2113)
- 1971-1975 WASSERMAN, A. E., Dr.
Agricultural Research Service, US Department of Agriculture
600 E Mermaid Lane, Philadelphia, Pennsylvania 19118 (USA)

Associate Members

- 1973-1975 BERGSTROM-NIELSEN, M., Dr.
Statens Levnedsmiddelinstitut
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- 1973-1975 COLLINGS, A. J., Dr.
Unilever Research Laboratory
Colworth House, Sharnbrook, Bedford MK44 1LQ (UK)

- 1971-1975 FISCHBACH, H., Dr.
Department of Health, Education, and Welfare, Food and
Drug Administration
200 C Street SW, Washington, DC 20204 (USA)
- 1971-1975 SCHULLER, P. L., Dr.
Rijks Instituut voor de Volksgezondheid
Antonie van Leeuwenhoeklaan 9, POB 1, Bilthoven (Netherlands)
- 1971-1975 TRUHAUT, R., Prof.
Chaire de Toxicologie, Faculté de Pharmacie, Université de
Paris
4 Avenue de l'Observatoire, F-75006 Paris Cedex 06 (France)

National Representatives

- Federal Republic of Germany* LÜCK, E., Dr.
Farbwerke Hoechst AG
1971- Postfach 800320, D-6230 Frankfurt/Main 80
- Hungary* VAS, K., Prof.
1971- Központi Élelmiszeripari Kutató Intézet
Herman Otto Út 15, Budapest II

VI.1.1 COMMISSION ON FOOD ADDITIVES

(Established in its present form 1971)

Titular Members

Chairman

- 1971-1975 HAENNI, E. O., Dr.
7907 Glenbrook Road, Bethesda, Maryland 20014 (USA)
(TEL: 301 652 3108)

Secretary

- 1967-1975 WASSERMAN, A. E., Dr.
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600 E Mermaid Lane, Philadelphia, Pennsylvania 19118 (USA)
(TEL: 215 248 5000)

Members

- 1971-1975 BELITZ, H. D., Prof.
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Lothstrasse 17/1, D-8000 München 2 (Federal Republic of Germany)
- 1971-1975 GRIMMER, G., Prof.
Bebelallee 30 A, D-2000 Hamburg 39 (Federal Republic of Germany)
- 1973-1977 POUILLAUE, F., Dr.
Lesieur Cotelte SA
65 Bis, Rue du Rocher, F-75008 Paris (France)
- 1973-1977 SOMERS, E., Dr.
Health Protection Branch, Department of Environment
Tunney's Pasture, Ottawa, Ontario K1A 0L2 (Canada)

Associate Members

- 1971-1975 DODGEN, D. F., Mr.
Food Chemicals Codex, National Academy of Sciences
National Research Council
2101 Constitution Avenue, Washington, DC 20418 (USA)
- 1971-1975 EDHBORG, A., Dr.
AB Findus
POB 85, S-267 00 Bjuv (Sweden)
- 1969-1975 KUBACKI, S. J., Dr.
Department of Instrumental Analysis, Institute of Fermentation
Industry
Ul. Rakowiecka 36, Warszawa 12 (Poland)
- 1973-1975 McDONALD, I. R. C., Mr.
Division of Chemistry, Department of Scientific and
Industrial Research
Private Bag, Petone (New Zealand)
- 1971-1975 WALKER, E. A., Mr.
Unit of Environmental Carcinogens, International Agency
for Research on Cancer
150 Cours Albert Thomas, F-69008 Lyon (France)

National Representative

Federal Republic BALTES, W., Prof.

of Germany Institut für Lebensmittelchemie der Technischen Universität
1971– Strasse des 17 Juni 1935, D-1000 Berlin 12

VI.1.2 COMMISSION ON FOOD CONTAMINANTS

(Established in its present form 1971)

Titular Members

Chairman

- 1973–1977 KOJIMA, K., Dr.
Laboratory for Medicinal Plants, National Institute of
Hygienic Sciences
30, Kasukabe, Kasukabe-shi, Saitama-ken, 344 (Japan)
(TEL: 0487 52 2077)

Secretary

- 1971–1975 OHNO, K., Dr.
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6,1-chome, Kyobashi, Chuo-ku, Tokyo 104 (Japan)
(TEL: 272 1111. TELEX: J22690/J24808)

Members

- 1973–1977 CAMPBELL, A. D., Dr.
Department of Health, Education, and Welfare, Food and
Drug Administration
200 C Street SW, Washington, DC 20204 (USA)
- 1971–1975 JONES, N. R., Dr.
Tropical Products Institute
56-62 Gray's Inn Road, London WC1X 8LU (UK)
- 1971–1975 KROGH, P., Dr.
Institute of Hygiene and Microbiology, Royal Veterinary and
Agricultural University
13 Bülowsvej, DK-1870 København V (Denmark)
- 1973–1977 SCHULLER, P. L., Dr.
Rijks Instituut voor der Volksgezondheid
Antonie van Leeuwenhoeklaan 9, POB 1, Bilthoven (Netherlands)

Associate Members

- 1971–1975 BILLEK, G., Prof.
Unilever Forschungsgesellschaft mbH
Behringstrasse 154, Postfach 1568, D-2000 Hamburg 50
(Federal Republic of Germany)
- 1971–1975 COLES, L. E., Dr.
County Public Health Laboratory, Institute of Preventive
Medicine
The Parade, Cardiff CF2 3VJ (UK)
- 1969–1975 HOWARD, H. W., Dr.
Borden Inc.
277 Park Avenue, New York, New York 10017 (USA)
- 1973–1975 JEMMALI, M., Dr.
Station de Biochimie et Physico-Chimie des Céréales, Institut
National de la Recherche Agronomique
16 Rue Nicolas Fortin, F-75013 Paris (France)

- 1973-1975 LITTLEHAILES, J. D., Dr.
Agricultural Division, Imperial Chemical Industries Ltd.
POB 1, Billingham, Teesside TS23 1LB (UK)
- 1973-1975 STEYN, P. S., Dr.
National Chemical Research Laboratory, Council for Scientific
and Industrial Research
POB 395, Pretoria (Republic of South Africa)

National Representative

Federal Republic of Germany KRÖNERT, W., Dr.
Max von Pettenkofer-Institut des Bundesgesundheitsamtes
1973- Unter den Eichen 82-84, D-1000 Berlin 33

VI.2 SECTION ON FERMENTATION

(Established 1957)

Titular Members

Chairman

- 1969–1975 KINOSHITA, S., Dr.
Kyowa Hakko Kogyo Co. Ltd.
Ohtemachi Building, Ohtemachi, Chiyoda-ku, POB 5170
Tokyo 100-31 (Japan)
(TEL: 201 7211. TELEX: J24543)

Vice-Chairman

- 1973–1977 HUMPHREY, A. B., Prof.
107 Towne Building—D3, College of Engineering and
Applied Science, University of Pennsylvania
Philadelphia, Pennsylvania 19174 (USA)
(TEL: 215 594 7245)

Secretary

- 1967–1975 HOOGERHEIDE, J. C., Dr.
Laan van Clingendael 129, 's Gravenhage (Netherlands)
(TEL: 070 240635)

Members

- 1969–1977 ERTOLA, R. J., Dr.
Departamento de Tecnologia Química, Facultad de Ciencias
Exactas, Universidad Nacional de la Plata
47 and 115, La Plata (Argentina)
- 1967–1975 FIECHTER, A., Prof.
Mikrobiologisches Institut der Eidgenössischen Technischen
Hochschule
Weinbergstrasse 38, CH-8006 Zürich (Switzerland)
- 1971–1975 HORVÁTH, I., Prof.
Biokémiai Intézet, Sammelweis Orvostudományi Egyetem
Puskin Utca 9, H-1088 Budapest VIII (Hungary)
- 1969–1977 MÁLEK, I., Acad.
Na Dolinách 18, CS-147 00 Praha 48 (Podolí)
(Czechoslovakia)
- 1967–1975 PIRT, S. J., Prof.
Department of Microbiology, Sir John Atkins Laboratories
Queen Elizabeth College
Campden Hill Road, London W8 7AH (UK)

Associate Members

- 1973–1975 DELLWEG, H., Prof.
Institut für Gärungsgewerbe und Biotechnologie
Seestrassse 13, D-1000 Berlin 65 (Federal Republic of Germany)
- 1972–1975 GHOSE, T. K., Prof.
Department of Chemical Engineering, Indian Institute
of Technology
Hauz Khas, New Delhi-16 (India)

- 1972-1975 LAINE, B. M., Dr.
BP Proteins Ltd.
Britannic House, Moor Lane, London EC2Y 9BU
- 1973-1975 LANGLYKKE, A. F., Dr.
American Society for Microbiology
1913 I Street NW, Washington, DC 20006 (USA)
- 1971-1975 PARISI, F., Dr.
Società Chimica Italiana - Sezione Lombarda
Piazzale Rodolfo Morandi 2, I-20121 Milano (Italy)
- 1973-1975 RALPH, B. P., Dr.
School of Biological Technology, University of New South
Wales
POB 1, Kensington, Sydney (Australia 2033)
- 1972-1975 STONE, L., Dr.
Hiram Walker & Sons Inc.
Peoria, Illinois 61601 (USA)
- 1969-1975 TERUI, G., Prof.
Department of Fermentation Technology, Faculty of Engineering
Osaka University
Yamada-kami, Suita-shi, Osaka (Japan)

National Representatives

- Austria* WUTZEL, H., Mr.
1974- Vereinigte Hefefabriken Mautner Maskhor und Wolfrum
Simmeringer Hauptstrasse 101, A-1110 Wien XI
- Federal Republic of Germany* BRONN, W. K., Mr.
1974- Institut für Gärungsgewerbe und Biotechnologie
Seestrasse 13, D-1000 Berlin 65

VI.3 SECTION ON OILS AND FATS

(Established 1938)

SECTION COMMITTEE

Titular Members

Chairman

- 1963-1975 Vos, H. J., Drs.
Populierenlaan 1a, NL-2660 Bosch en Duin (Netherlands)
(TEL: 03404 31703)

Secretary

- 1973-1977 PAQUOT, C., Prof.
Groupe de Laboratoires du Centre National de la Recherche
Scientifique
2-8 Rue Henri Dunant, F-94320 Thiais (France)
(TEL: 726 0840)

Members

- 1973-1977 BRÜSCHWEILER, H., Dr.
Eidgenössische Materialprüfungs- und Versuchsanstalt für
Industrie, Bauwesen und Gewerbe
Unterstrasse 11, CH-9001 St-Gallen (Switzerland)
- 1973-1977 DELVAUX, E. L., Prof.
Leo Dartelaan 27, B-3030 Heverlee (Belgium)
- 1969-1975 EMBREE, N. D., Dr.
Health and Nutrition Research Division, Tennessee Eastman Co.
Kingsport, Tennessee 37662 (USA)
- 1973-1977 GRACIAN TOUS, J., Dr.
Instituto de la Grasa y sus Derivados, Consejo Superior de
Investigaciones Científicas
Avenida Padre García Tejero 4, Sevilla (Spain)
- 1973-1977 MØLLER, A. T., Mr.
Aarhus Oliefabrik A/S
DK-8100 Aarhus C (Denmark)
- 1973-1977 VAN DER WEEL, J. C., Drs.
Unilever-Emery NV
Buurtje 1, POB 2, NL-2300 Gouda (Netherlands)

VI.3.1 COMMISSION ON OILS AND FATS

(Established 1971)

Titular Members

Chairman

- 1973-1977 DELVAUX, E. L., Prof.
Leo Dartelaan 27, B-3030 Heverlee (Belgium)
(TEL: 016 22331)

Secretary

- 1973-1977 PAQUOT, C., Prof.
Groupe de Laboratoires du Centre National de la Recherche
Scientifique
2-8 Rue Henri Dunant, F-94320 Thiais (France)
(TEL: 726 0840)

Members

- 1973-1977 BRÜSCHWEILER, H., Dr.
Eidgenössische Materialprüfungs- und Versuchsanstalt für
Industrie, Bauwesen und Gewerbe
Unterstrasse 11, CH-9001 St-Gallen (Switzerland)
- 1971-1975 EMBREE, N. D., Dr.
Health and Nutrition Research Division, Tennessee Eastman Co.
Kingsport, Tennessee 37662 (USA)
- 1973-1977 GRACIAN TOUS, J., Dr.
Instituto de la Grasa y sus Derivados, Consejo Superior de
Investigaciones Científicas
Avenida Padre García Tejero 4, Sevilla (Spain)
- 1973-1977 MØLLER, A. T., Mr.
Aarhus Oliefabrik A/S
DK-8100 Aarhus C (Denmark)
- 1971-1975 VOS, H. J., Drs.
Populierenlaan 1a, NL-2660 Bosch en Duin (Netherlands)
- 1973-1977 VAN DER WEEL, J. C., Drs.
Unilever-Emery NV
Buurtje 1, POB 2, NL-2300 Gouda (Netherlands)

Associate Members

- 1973-1975 CAROLA, C., Dr.
Stazione Sperimentale per le Industrie degli Oli e dei Grassi
Via Guiseppe Colombo 79, I-20135 Milano (Italy)
- 1971-1975 CORNELIUS, J. A., Dr.
Tropical Products Institute
56-62 Gray's Inn Road, London WC1X 8LU (UK)
- 1971-1975 HADORN, H., Dr.
Coop Schweiz, Zentrallabor
Thiersteinerallee 14, CH-4002 Basel (Switzerland)
- 1971-1975 MARTINEZ-MORENO, J., Prof.
Instituto de la Grasa y sus Derivados, Consejo Superior de
Investigaciones Científicas
Avenida Padre García Tejero 4, Sevilla (Spain)

- 1971-1975 NAUDET, M., Prof.
Laboratoire National des Matières Grasses, Institut de Chimie
des Corps Gras, Faculté des Sciences, Université de Provence
Place Victor Hugo, F-13331 Marseille Cedex 3 (France)
- 1971-1975 PETERSEN, A., Mr.
Margarinefabrikken Alfa A/S
DK-6600 Vejen (Denmark)
- 1971-1975 RUTKOWSKI, A., Prof.
Faculty of Food Technology, Szkoła Główna Gospodarstwa
Wiejskiego
Ul. Rakowiecka 26-30, PL 02-528 Warszawa (Poland)

National Representatives

- Argentina* CATTANEO, P., Prof.
1971- Instituto Argentino de Racionalización de Materiales
Calle Chile No. 1192, Buenos Aires
- Belgium* JACOBSBERG, B., Miss
1971- Centre d'Enseignements et de Recherches des Industries
Alimentaires et Chimiques
1 Avenue Emile Gryzon, B-1070 Bruxelles
- Canada* CRAIG, B. M., Dr.
1972- Prairie Regional Laboratory, National Research Council
of Canada
Saskatoon, Saskatchewan
- Czechoslovakia* POKORNÝ, J., Dr.
1971- Katedra Chemie a Zkoušení Potravin, Vysoké Školy Chemiko-
Technologické v Praze
Suchbátarova 5, CS-166 28 Praha 6-Dejvice
- Denmark* LINTZ CHRISTENSEN, S. B., Mr.
1971- Dansk Sojakagefabrik A/S
24 Islands Brygge, DK-2300 København S
- Federal Republic of Germany* WENDT, H. H. R. H., Dr.
1971- Margarine-Union GmbH
Friedensallee 333, D-2000 Hamburg 50
- Hungary* HOLLÓ, J., Prof.
1971- Mezőgazdasági Kémiai Technológia Tanszék, Budapesti
Műszaki Egyetem
Gellért Tér 4, Budapest XI
- India* KANE, J. G., Prof.
1971- Department of Chemical Technology, University of Bombay
Matunga Road, Bombay-19
- Ireland* MCGWYNNE, B. M., Mr.
1971- Irish Oil Cake Mills Ltd.
Marsh Road, Drogheda, County Louth
- Italy* MONACELLI, R., Prof.
1971- Istituto Superiore di Sanità
Viale Regina Elena 299, I-00161 Roma

- Japan* HASHIMOTO, T., Dr.
1974- National Chemical Laboratory for Industry, Ministry of
International Trade and Industry
1-5 Honmachi 1, Shibuya-ku, Tokyo 151
- Netherlands* HENDRIKSE, P. W., Drs.
1973- Unilever Research Laboratorium
POB 114, Vlaardingen
- New Zealand* BROOKER, S. G., Mr.
1971- Abels Ltd.
101 Carlton Gore Road, POB 9573, New Market, Auckland
- Nigeria* EKONG, D. E. U., Dr.
1971- Department of Chemistry, University of Ibadan
Ibadan
- Poland* JAKUBOWSKI, A., Dr.
1971- Instytut Przemysłu Tłuszczowego
Ul. Rakowiecká 36, Warszawa 12
- Sweden* OHLSON, R., Dr.
1971- Research Laboratory, AB Karlshamns Oljefabriker
S-292 00 Karlshamn
- Switzerland* DIEFFENBACHER, A., Dr.
1973- Oel- und Fettswerke SAIS
CH-9326 Horn
- United States of America* KUMMEROW, F. A., Prof.
1973- Department of Food Chemistry, University of Illinois
Urbana, Illinois 61801

VI.3.2 COMMISSION ON SOAPS AND OLEOCHEMICALS

(Established 1971)

Titular Members

Chairman

- 1973-1977 MØLLER, A. T., Mr.
Aarhus Oliefabrik A/S
DK-8100 Aarhus C (Denmark)
(TEL: 06 126000)

Secretary

- 1973-1977 PAQUOT, C., Prof.
Groupe de Laboratoires du Centre National de la Recherche
Scientifique
2-8 Rue Henri Dunant, F-94320 Thiais (France)
(TEL: 726 0840)

Members

- 1973-1977 BRÜSCHWEILER, H., Dr.
Eidgenössische Materialprüfungs- und Versuchsanstalt für
Industrie, Bauwesen und Gewerbe
Unterstrasse 11, CH-9001 St-Gallen (Switzerland)
- 1973-1977 DELVAUX, E. L., Prof.
Leo Dartelaan 27, B-3030 Heverlee (Belgium)
- 1971-1975 EMBREE, N. D., Dr.
Health and Nutrition Research Division, Tennessee Eastman Co.
Kingsport, Tennessee 37662 (USA)
- 1973-1977 GRACIAN TOUS, J., Dr.
Instituto de la Grasa y sus Derivados, Consejo Superior de
Investigaciones Científicas
Avenida Padre García Tejero 4, Sevilla (Spain)
- 1971-1975 VOS, H. J., Drs.
Populierenlaan 1a, NL-2660 Bosch en Duin (Netherlands)
- 1973-1977 VAN DER WEEL, J. C., Drs.
Unilever-Emery NV
Buurtje 1, POB 2, NL-2300 Gouda (Netherlands)

Associate Members

- 1974-1975 ASAHARA, T., Prof.
Faculty of Engineering, University of Tokyo
3-1 Hongo 7-chome, Bunkyo-ku, Tokyo 113 (Japan)
- 1973-1975 CONNOLLY, J. F., Dr.
Animal Production Research Centre, Agricultural Institute
Dunsinea, Castleknock, Co. Dublin (Ireland)
- 1971-1975 GULLBRANDSON, B., Mr.
AB Helios Kemisk-Tekniska Fabriker
Tellusborgsvägen 100, Stockholm 32 (Sweden)
- 1971-1975 WOLFF, J. P., Mr.
Laboratoires Wolff
198 Avenue du Belvédère, F-75019 Paris (France)

National Representatives

- Federal Republic of Germany* TEUPEL, M., Dr.
1971- Henkel & Cie GmbH
Postfach 1100, D-4000 Düsseldorf 1
- France* DESNUELLE, P., Prof.
1971- Institut de Chimie Biologique, Université de Provence
Place Victor Hugo, F-13331 Marseille Cedex 3
- Ireland* REYNOLDS, D. C., Mr.
1972- Lever Bros. (Ireland) Ltd.
68 Upper Sheriff Street, Dublin 1
- Italy* BALESTRINI, G., Dr.
1971- Via Tamburini 12, I-20123 Milano
- Japan* TOMIYAMA, S., Dr.
1974- Lion Fat and Oil Co. Ltd.
Yokoami-1-2-22, Sumida-ku, Tokyo
- New Zealand* SHORLAND, F. B., Dr.
1971- POB 2447, Wellington
- Poland* NIEWIADOMSKI, H., Prof.
1971- Organicznej Oraz Żywnościowej, Instytut Chemii i Technologii
Politechnika Gdańska
Ul. Majakowskiego 11-12, Gdańsk-Wrzeszcz
- Spain* GASSIOT-MATAS, M., Dr.
1971- Instituto Químico de Sarriá
Barcelona 17
- Sweden* LEVIN, Ö., Dr.
1971- Margarinbolaget AB
Fack, S-104 25 Stockholm 30
- United Kingdom* LEWKOWITSCH, P. R. E., Dr.
1971- 71 Priory Road, West Hampstead, London NW6 3NH

VI.4 SECTION ON AIR QUALITY

(Established in its present form 1971)

Titular Members

Chairman

- 1967–1975 **MONKMAN, J. L., Mr.**
Air Pollution Control Directorate, Environmental Health Centre
Department of Environment
Tunney's Pasture, Ottawa, Ontario K1A 0H3 (Canada)
(TEL: 613 996 7333)

Secretary

- 1971–1975 **SMITH, R. G., Prof.**
School of Public Health, University of Michigan
109 Observatory Street, Ann Arbor, Michigan 48104 (USA)
(TEL: 313 764 2594)

Members

- 1973–1977 **FUGAŠ, M., Dr.**
Institute for Medical Research and Occupational Health
Moše Pijade 158, YU-41000 Zagreb (Yugoslavia)
- 1973–1977 **LUXON, S. G., Mr.**
Department of Employment
Baynards House, 1 Chepstow Place, Westbourne Grove
London W2 (UK)
- 1971–1975 **MUELLER, P. K., Dr.**
290 Los Cerros Avenue, Walnut Creek, California 94598 (USA)
- 1973–1977 **PILZ, W., Dr.**
Physiologisch-Chemisches und Analytisches Labors der
Ärztlichen Abteilung, Farbenfabriken Bayer AG
D-5090 Leverkusen-Bayerwerk (Federal Republic of Germany)
- 1973–1977 **TRUHAUT, R., Prof.**
Chaire de Toxicologie, Faculté de Pharmacie, Université de
Paris
4 Avenue de l'Observatoire, F-75006 Paris Cedex 06 (France)
- 1971–1975 **ZURLO, N., Prof.**
Istituto Clinici di Perfezionamento dell' Università di Milano
Via San Barnaba 8, I-20122 Milano (Italy)

Associate Members

- 1969–1975 **BOUDENE, C., Prof.**
Faculté de Pharmacie, Université de Paris
4 Avenue de l'Observatoire, F-75006 Paris Cedex 06 (France)
- 1973–1975 **FREDERICK, W. G., Dr.**
Department of Occupational and Environmental Health, School
of Medicine, Wayne State University
625 Mullett Street, Detroit, Michigan 48226 (USA)
- 1973–1975 **GAGE, J. C., Dr.**
Institutionen för Hygien, Lunds Universitet
POB 2009, S-220 02 Lund 2 (Sweden)

VI.5.1 COMMISSION ON TERMINAL PESTICIDE RESIDUES

(Established 1965)

Titular Members

Chairman

- 1968-1975 HILL, K. R., Dr.
Analytical Chemistry Laboratory, Agricultural Environmental
Quality Institute, US Department of Agriculture
Beltsville, Maryland 20705 (USA)
(TEL: 301 344 2495)

Secretary

- 1973-1977 KEARNEY, P. C., Dr.
Pesticide Degradation Laboratory, Agricultural Environmental
Quality Institute, US Department of Agriculture
Beltsville, Maryland 20705 (USA)
(TEL: 301 344 3082)

Members

- 1971-1975 BARON, R. L., Dr.
Primate and Pesticides Effects Laboratory, Environmental
Protection Agency
POB 490, Perrine, Florida 33157
- 1973-1977 CROSBY, D. G., Dr.
Agricultural Toxicology and Residue Research Laboratory
University of California
Davis, California 95616 (USA)
- 1971-1975 GEISSBÜHLER, H., Dr.
Agrochemical Research Department, CIBA-GEIGY AG
CH-4002 Basel (Switzerland)
- 1971-1975 KORTE, F., Prof.
Institut für Ökologische Chemie der Gesellschaft für Strahlen-
und Umweltforschung mbH München
Postfach 1260, D-5205 St-Augustin 1 (Federal Republic of
Germany)
- 1973-1977 MIYAMOTO, J., Dr.
Research Department, Pesticides Division, Sumitomo Chemical
Co. Ltd.
2-1, Takatsukasa 4, Takarazuka-shi, Hyogo 665 (Japan)
- 1973-1977 SLADE, P., Dr.
ICI Plant Protection Ltd.
Jealott's Hill Research Station, Bracknell RG12 6EY
Berkshire (UK)

Associate Members

- 1971-1975 DEKHUIZEN, H. M., Dr.
Organisch Chemisch Instituut, Organisatie voor Toggapast
Natuurwetenschappelijk Onderzoek
Croesestraat 79, POB 5009, Utrecht (Netherlands)

- 1971-1975 DRESCHER, N., Dr.
Badische Anilin- und Soda-Fabrik AG
Landw. Versuchsstation, Postfach 220, D-6703 Limbürghof
(Federal Republic of Germany)
- 1973-1975 ENGST, R., Prof.
Zentralinstitut für Ernährung der Akademie der Wissenschaften
der DDR
Arthur-Scheunert-Allee, 1501 Bergholz-Rehbrücke (German
Democratic Republic)
- 1973-1975 GREENHALGH, R., Dr.
Environmental Chemistry Section, Chemistry and Biology
Research Institute, Research Branch, Canada Department of
Agriculture,
Ottawa, Ontario (Canada)
- 1973-1975 MAYR, G. E., Dr.
Deutsche Gesellschaft für Schädlingsbekämpfung mbH
Neue Mainzer Strasse 1, Postfach 2644, D-6000 Frankfurt/
Main 1 (Federal Republic of Germany)
- 1967-1975 PORTER, P. E., Dr.
Shell Development Co.
POB 4248, Modesto, California 95352 (USA)

STANDING ORDERS OF EXECUTIVE COMMITTEE REGARDING COMMITTEE ON PUBLICATIONS

Composition and Terms of Office

- (i) There shall be a standing Committee on Publications composed of a Chairman and at least three and not more than five other Members, of whom one shall be the Scientific Editor.
- (ii) The President in consultation with the Executive Committee shall appoint Members. The Committee on Publications may propose names of persons suitably qualified for appointment.
- (iii) The maximum period of service of ordinary Members shall be eight years, except that by special permission of the President one of the Foundation Members* may serve for ten years and one for twelve years.
- (iv) In order to ensure continuity, except for the Scientific Editor, Members shall be replaced at two-year intervals, beginning in 1977, one Member at a time.
- (v) The Membership shall be reviewed every two years by the incoming President in consultation with the Executive Committee.
- (vi) The President in consultation with the Executive Committee shall appoint the Chairman. The Committee on Publications may propose candidates.
- (vii) The period of service of the Chairman shall not exceed eight years. The sum of years of service as an ordinary Member and as Chairman shall not exceed ten years.

Terms of Reference

- (i) To advise the President and the Executive Committee on all matters of publications including policy.
- (ii) To make recommendations for decision by the President and/or Executive Committee.

* Those appointed in 1969 at the establishment of the Committee.

STANDING ORDERS OF EXECUTIVE COMMITTEE REGARDING COMMITTEE ON SCOPE

Composition and Terms of Office

- (i) There shall be a standing Committee for SCOPE (ICSU Scientific Committee on Problems of the Environment) composed of a Chairman and not more than seven other Members.
- (ii) The President in consultation with the Executive Committee shall appoint Members. The Committee for SCOPE may propose names of persons suitably qualified for appointment.
- (iii) The maximum period of service of ordinary Members shall be eight years.
- (iv) The Membership shall be reviewed every two years by the incoming President in consultation with the Executive Committee.
- (v) The President in consultation with the Executive Committee shall appoint the Chairman. The Committee for SCOPE may propose candidates.
- (vi) The Chairman of the Committee for SCOPE shall be the official representative of IUPAC on SCOPE. The period of service of the Chairman shall not exceed eight years. The sum of the years of service as an ordinary Member and as Chairman shall not exceed ten years.

Terms of Reference

- (i) To advise the President and Executive Committee on the programmes and policies of SCOPE.
- (ii) Subject to the prior approval of the President and/or the Executive Committee, to carry out assignments agreed upon with SCOPE and to assist SCOPE generally in its activities.

STANDING ORDERS OF EXECUTIVE COMMITTEE REGARDING FINANCE COMMITTEE

Composition and Terms of Office

- (i) There shall be a standing Finance Committee composed of five Members and a Chairman. In addition, the Treasurer shall be an ex-officio Member but without voting power.
- (ii) The President in consultation with the Executive Committee shall appoint Members. The Finance Committee may propose names of persons suitably qualified for appointment.
- (iii) The maximum period of service of ordinary Members shall be eight years.
- (iv) The Membership shall be reviewed every two years by the incoming President in consultation with the Executive Committee.
- (v) The President in consultation with the Executive Committee shall appoint the Chairman. The Finance Committee may propose candidates.
- (vi) The period of service of the Chairman shall not exceed eight years. The sum of the years of service as an ordinary Member and as Chairman shall not exceed ten years.

Terms of Reference

- (i) To advise the President and the Executive Committee on financial matters.
- (ii) To make recommendations for decision by the President and/or Executive Committee.
- (iii) To review the IUPAC investment portfolio at least annually and make such changes as appear appropriate.
- (iv) The Finance Committee shall not have executive functions except with respect to dealings in securities. The Finance Committee shall have executive authority with respect to selection, purchases, and sales of securities held by IUPAC, provided that the Treasurer and the IUPAC Banker concur with the decisions of the Finance Committee.

STANDING ORDERS OF EXECUTIVE COMMITTEE REGARDING INTER-DIVISIONAL COMMITTEE ON MACHINE DOCUMENTATION IN THE CHEMICAL FIELD

Composition and Terms of Office

- (i) There shall be a standing Interdivisional Committee on Machine Documentation in the Chemical Field composed of a Chairman, a Secretary, and six other Members. It shall have representatives who are directly involved in editorial programmes, especially primary and secondary publications.
- (ii) The President in consultation with the Executive Committee shall appoint Members. The Interdivisional Committee may propose names of persons suitably qualified for appointment.
- (iii) The maximum period of service of ordinary Members shall be eight years.
- (iv) The Membership shall be reviewed every two years by the incoming President in consultation with the Executive Committee.
- (v) The President in consultation with the Executive Committee shall appoint the Chairman and the Secretary. The Interdivisional Committee may propose candidates.
- (vi) The period of service of the Chairman and of the Secretary shall not exceed eight years. The sum of the years of service as an ordinary Member and as Chairman or Secretary shall not exceed ten years.

Terms of Reference

- (i) To advise the President and Executive Committee on machine documentation matters in the chemical field.
- (ii) Subject to the prior approval of the President and/or the Executive Committee, to work on methods for standardization and codification in the machine documentation field. The first task shall be directed towards the machine handling of chemical structures and the computer generation of nomenclature in consultation with the relevant IUPAC Commissions.

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— PART B

MUNICH

21—31 August 1973

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COMPTES RENDUS XXVII CONFERENCE

— PART B

MUNICH
21—31 August 1973

B. XXVII IUPAC CONFERENCE

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*These Delegates have the status of Observer and they are not entitled to vote.

AGENDA FOR XXVII COUNCIL MEETING

Munich, 29 and 31 August 1973

1. Finalization of Agenda
2. Approval of Minutes of XXVI Council Meeting
3. Announcement of Nominations for Officers and Bureau Members
4. Announcement of Time of Elections
5. Statutory Report of President on State of the Union
6. Biennial Report of Treasurer
7. Report of Finance Committee
8. Application for National Adhering Organization Status
9. Applications for Associated Organization Status
10. Tentative Budgets for 1974 and 1975
11. Dues Structure and fixing Annual Dues for 1974 and 1975
12. Reports of Division Presidents and Clinical Chemistry Section
13. Report of Committee on Teaching of Chemistry
14. Report of Committee on Publications
15. Report on International Office for Analytical Chemistry
16. Period of Office of IUPAC Treasurer
17. Adoption of Nomenclature Rules
18. Bureau Proposals for New Bodies
19. Ratification of Decisions taken by Bureau and Executive Committee since XXVI Conference
20. Elections
21. Ratification of Dates and Place of XXVIII Conference and XXV Congress
22. Place of XXIX Conference and XXVI Congress
23. Any Other Business (Discussion only)

REPORT OF PRESIDENT ON STATE OF THE UNION

IUPAC 1971—3

In the biennial report on the state of the Union which I have the honour to present to Council, I do not propose to analyse at length the results of scientific work carried out in our various specialist Commissions, although this work is, of course, the sole reason for the existence of our Union. The Division Presidents and Chairmen of IUPAC bodies attached directly to the Bureau will shortly present their reports with a skill I shall not attempt to emulate. On the contrary and following the examples of most of my predecessors, I shall place before you a number of general questions on which I have been concentrating during the last two years. In my opinion some of them involve the very future of our Union. My reflections are based mostly on exchanges of views I have had with some of you and they will recognize their own ideas in due course. I must mention here the particular debt of gratitude I owe to Members of the Executive Committee, who have never been stinting in their support, and also to the Bureau. However, the conclusions I have arrived at in some cases are entirely personal and involve nobody else.

My first subject concerns the establishment of nomenclature rules in our various Divisions. As everyone knows, this task was felt to be of paramount importance by our founders. For many years two Commissions have shared this task, one in organic chemistry and the other in inorganic chemistry. Their recommendations have been adopted universally by the chemical community. Due to the evolution of chemical science on the one hand and changes in methods and documentation techniques on the other, more difficulties have arisen in recent years. In chemical science, enormous families of compounds have been developed to which it is difficult to apply traditional nomenclature, but on which our different bodies, because of their special expertise, have been able to make recommendations, *e.g.*, coordination compounds, boron and silicon compounds, stoichiometric phases, and macromolecules with biological activity. Simultaneously, Commissions on nomenclature have been created in other Divisions which are, of course, entirely justified, but whose activities need to be coordinated with existing Commissions. Experience has shown that the exchange of observers between these various Commissions has been very useful. However, it has become obvious that certain fundamental disagreements cannot be resolved in this way because perfect harmony in frontier areas of nomenclature, between inorganic and organic chemistry for example, would require a complete revision of the general system adopted by at least one of the partners, and this cannot possibly be envisaged. Another problem of standardization of nomenclature is to persuade authors of reports and works published under our name to use rules of nomenclature that we have officially adopted.

Alongside those aspects I have mentioned is that of our relationships with powerful organizations which in some countries publish original scientific work and abstracts. Although our methods of work are and must be distinct, in my opinion we should collaborate with them because the common aim is to work for the benefit of the scientific community. The presence of rep-

representatives from these organizations in some of our Commissions offers us an opportunity to collaborate, providing that good will exists on both sides and this is obviously the case. The activities of our Interdivisional Committee on Machine Documentation must also be included in this policy.

It was in this context that Council approved several years ago the creation of an Interdivisional Committee on Nomenclature and Symbols, which has been chaired in turn by Profs. K. A. JENSEN and M. L. MCGLASHAN with a skill I am pleased to acknowledge. Experience seems to have shown, however, that deprived of sufficient powers, this Committee has not been in a position to achieve a proper coordination of nomenclature activities which are presently divided amongst several Divisions. This is why the Executive Committee has approved the creation of an *ad hoc* Committee, chaired by Prof. N. LOZAC'H, to study ways and means of improving the present situation. The report of the *ad hoc* Committee is not to hand as I write this report, but without wishing to prejudge its conclusions, I think it might be useful to examine carefully the possibility of regrouping all our nomenclature activities and possibly symbols in a common Division.

My second subject is the place applied chemistry occupies throughout our organization, not only in our Applied Chemistry Division. This is not a new subject and you will recall that most of my predecessors, some of them eminent in industry, have been involved with it.

The fact that this problem arises at all our meetings shows that an easy solution is not within reach. The Bureau and Executive Committee have spent the last two years trying to increase the interest of their Members in applied chemistry. In a moment, Dr. R. W. CAIRNS, President of the Applied Chemistry Division, will tell you about achievements in his Division and I do not wish to anticipate his report. However, it should be mentioned once again that well before public opinion and, under pressure from this, governments began to take note of the dangers of pollution, IUPAC had already taken initiatives in devoting the work of several of its Commissions to study environmental problems. The decision some years ago to concentrate the efforts of the Applied Chemistry Division in this direction has proved an excellent one and we have maintained this policy. However, we must not forget the fact that IUPAC's applied work is not limited to the activities of the Sections attached to that Division. Of equal relevance surely is the work carried out by the Macromolecular and Analytical Chemistry Divisions and by the Sections on Medicinal and Clinical Chemistry.

One of the interesting aspects of IUPAC in the applied field is the existence of Company Associates. This year we have been pleased to see companies from new countries joining the scheme and the total number of Company Associates has now risen to nearly 150. However, we must guard against undue optimism because even amongst those companies who have willingly subscribed, following friendly requests from several of us, there are some who are not entirely convinced of the usefulness of our activities. Further, the financial climate in the world at the moment has led many chemical companies to reduce their budgets in respect of expenditures they consider merely philanthropic. This is why we decided to organize an Open Meeting during this Conference and invited participation by representatives of Company Associates and Members of our Commissions who work mainly in industry. Following a tentative step in this direction at Cortina d'Ampezzo in 1969, we hope that as a result of this meeting the voice of industry will be heard

and it will tell us what it expects from the Union. I take this opportunity of placing myself firmly against the interpretation which would wish to limit this action to its financial aspects. Applied chemistry, as well as pure chemistry, is written into the title of the Union and it is natural that both spheres cooperate in its work. It could be suggested that an opportunity should be offered to Company Associates as soon as possible to have a statutory voice at a high level in the affairs of our organization.

The question has often been asked whether the difficulties of applied chemistry in IUPAC are due to the structure itself. It is obvious that a largely arbitrary grouping of Sections and Commissions on applied chemistry in one Division does not really favour contacts with pure chemistry Commissions. The remedy of bringing in large numbers of industrial Members to our Commissions may not be the best, because if one sets apart Sections and Commissions which relate to the Applied Chemistry Division and some others which relate to the Analytical Chemistry and Macromolecular Divisions, I see little in them to attract true representatives from industry.

A more realistic approach would undoubtedly be to adapt our present very rigid structure in the fields where evolution is fast and often proceeds in an unexpected way. This could be achieved by superimposing, and eventually substituting, the present system of Sections and Commissions by a more flexible system of operation based on precise objectives whose term as well as resources would be strictly specified. It will be for our successors to explore this possibility which I am sure would enable our organization to follow more closely all the variations of outlook in applied chemistry, at the same time ensuring a better utilization of our limited finances.

The third subject I would like to bring to your attention concerns the development and rationalization of the Union's external relationships. This development has become considerable in recent years and has constituted an important part of our preoccupations in the last two years. We must, however, take into account the fact that in spite of the foresight of the Union's founders, our organization remained for many years an association of scientists who placed the development of the science to which they had devoted their lives at the very head of their preoccupations. Also, the division of the scientific disciplines rarely necessitated interdisciplinary liaison. Recently, however, the system of values on which this structure reposed has received attacks from several sides. On one side, the man in the street demands the benefits of science with an ever-increasing energy, and the scientist is considered responsible for the extremely rapid evolution of society for better or worse. Therefore, it would be unreasonable for an organization such as ours to dissociate itself from the implications of its activities in such fields as pollution, food, health, and education, to name only a few. From this arises the absolute necessity of cooperating with numerous organizations which deal primarily with these problems. You will know from reading the reports of our expert Commissions the exact contacts at their level with many outside organizations. But it is necessary that in certain cases the foundations of this cooperation should be laid down officially. Some contacts have been in existence for some time, but others have either recently been established or renewed by us. In this respect, we send delegates to various ICSU special-interest committees, such as the Abstracting Board, CODATA, COSPAR, COWAR, SCOPE, and your President is, of course, on the General Committee of ICSU. We also maintain irregular contact with IUB, IUPAB,

IUPAC, and IUCr. I am pleased to tell you that useful contacts have recently been established between IUB and IUPAC on the occasion of a meeting attended in particular by the IUB President, Prof. H. THEORELL, and by SIR HAROLD THOMPSON, Prof. LOZAC'H, and myself.

Relations are also maintained with intergovernmental organizations, in particular, WHO, FAO, and UNESCO. Our collaboration with UNESCO, mainly in the field of teaching of science, will be cemented this year by the organization of an international congress on teaching of chemistry under the joint sponsorship of UNESCO and IUPAC. Our Committee on Teaching of Chemistry will, of course, be in attendance led by its Chairman, Prof. R. W. PARRY. Also in this category of organization is CEE with whom we have had a fruitful collaboration over many years in the field of analytical chemistry, thanks to the notable activity of the Coordinating Committee under the Chairmanship of Prof. R. TRUHAUT.

Another aspect of relationship IUPAC has with outside organizations which should not be forgotten is that of our contacts with scientific and technological societies devoted to chemistry. These are involved with us thanks to the Statute concerning Associated Organizations. This very flexible form of association only involves societies whose international nature is evident and whose scientific level is beyond reproach. This follows a recent decision of the Bureau which would avoid our falling into the error of ignoring the development of organizations whose aims are complementary to ours as well as the opposite, and any endeavour by the Union to assume exclusive control of all international chemical activity which would be completely beyond our means. We hope, however, that IUPAC will continue to be privileged to meet all those organizations which in various capacities devote themselves to these activities. It is in this spirit that we are proposing to Council the admission of several new Associated Organizations, including International Association for Advancement of High Pressure Science and Technology, International Committee for Rheology, International Conferences on Coordination Chemistry, International Society for Heterocyclic Chemistry. I take this opportunity of welcoming Delegates from the existing Associated Organizations here to follow our work during the Conference.

It would be unfair not to mention here the relationships which IUPAC has externally in the important role of sponsorships given each year to a carefully chosen number of symposia and congresses. This label is becoming more and more coveted, quite independently of any financial assistance which is sometimes also given, by organizers of some of the most reputed meetings and we can only be happy that this situation reflects moral credit on our Union. This gives our official representatives an opportunity to speak in front of huge audiences about our aims and activities. The granting of sponsorship is only given, as you all know, after certain conditions concerning the publication of plenary lectures in the IUPAC journal *Pure and Applied Chemistry* have been fulfilled. I must note here that more flexibility has been exercised by the Union recently in this respect. Sir HAROLD THOMPSON will no doubt inform us about this in his report on behalf of the Committee on Publications.

At the end of this quick review of our relationships with outside organizations I think I can confirm that we have established contacts wherever they appear to be necessary and that nobody can accuse us of living in an ivory tower. The, in general, very positive results of our collaborations constitute an important part of the balance sheet of our activities and this is why I drew your attention to them. I am pleased to record my thanks here to all

our delegates who throughout the world have represented us and brought knowledge of IUPAC to those who perhaps were not previously aware of our activities.

We must now make a big effort to disseminate better information on our activities, not only in industry but also in academies and universities. It was with this aim that the Executive Committee asked Sir HAROLD THOMPSON to prepare an article containing general information about IUPAC. This received a wide circulation. Also, a more specialized brochure was prepared by Mr. P. M. ARNOLD for industrial use and was distributed widely. Finally, information on IUPAC activities is sent at regular intervals to the principal national chemistry news journals with a request for publication.

Council must now be informed about our actions in respect of revision of the 1965 IUPAC Statutes in light of our current requirements. You are aware that over the years, the evolution of our organization has inevitably necessitated revision of particular aspects of our Statutes and Bylaws. It is enough to recall that these Statutes ignore completely the existence of both Standing Committees and Company Associates; that directives for Sections and Sub-Commissions are too vague; that there is no legal basis for the existence of Working Parties and other bodies created as various circumstances arose.

For this very good reason my predecessor asked Council to create a Committee which would prepare such modifications to the Statutes and Bylaws as were thought necessary. A consultation was organized amongst the Bureau, Division Presidents and Secretaries, and Officers of Standing Committees of IUPAC to establish a list of suggested modifications and these are currently being studied by the Committee under the Chairmanship of Sir DAVID MARTIN and by the Executive Committee. For statutory reasons new proposals cannot be submitted to Council before 1975. Without wishing to anticipate the conclusions of these studies, I think it might be useful to make a distinction between modifications of detail which seem necessary and could be approved fairly readily, and those which concern the future policy of the Union and therefore require deeper study.

In this context, we were asked to undertake a specific task. It was to codify the terms of reference of Standing Committees attached to the Bureau whose functioning has been on a *de facto* basis for many years. This work, which was first completed for the Finance Committee, has been followed for the Committee on Teaching of Chemistry, Committee on Publications, and Committee on Statutes and Bylaws. Terms of reference have been drafted for the Liaison Committee on SCOPE and Interdivisional Committee on Machine Documentation, and they are in preparation for the Coordinating Committee for CEE. In my opinion they have the great advantage of avoiding the possibility that these Committees may gradually deviate from the objectives laid down at the time of their creation. They also ensure, by fixing terms for length of service, that the composition of the Committees is renewed regularly. This corresponds to a general principle to which I am very attached, namely that no appointment is made without a time limit. That is why I have asked the Executive Committee to approve a rule that our official representatives on other organizations appointed by the President shall not exceed that President's term of office. This leaves the new President entirely free to reconsider, if he so wishes, the appointments made by his predecessor.

Nobody will wish me to ignore the subjects of finance and publications during my biennial report. I have not discussed these matters as priorities, not because I think them of less importance, but because they are the responsibility of two people far more expert than me. You will shortly be hearing the reports of Prof. O. HORN and Sir HAROLD THOMPSON and I will, therefore, make only a few general remarks on these subjects.

Concerning finance, I shall confine myself to referring to two basic principles: the first is the fact that expenditure must be related to income, and the second is that sufficient reserves are necessary to ensure effective administration. I must say that IUPAC gives me complete satisfaction on both these points although, of course, this result has not always been achieved easily. Our good position arises thanks to the skill and untiring activity of our Treasurer, Prof. HORN, to whom I would like to extend our appreciation. The advice of the Finance Committee under the excellent Chairmanship of Dr. J. W. BARRETT must also be recognized. It is unnecessary to remind you of how thankless a task it is to run the finances of an organization like ours, because objections to certain expenditures are not always easily understood or admitted by those who propose them. No less thankless is the task of the President, who sometimes has to arbitrate in disagreements which anyway should remain amicable. I must strongly reiterate here that financial problems cannot be dissociated from the idea that we ourselves provide the objectives for our organization and that any positions taken up in this must be justified by reference to these objectives.

On the subject of publications, I shall content myself with a request to Council to listen carefully to the report from Sir HAROLD THOMPSON on behalf of the Committee on Publications. Although this report is traditional, this year it is something special because Sir HAROLD does not feel it possible for him to continue as Chairman when he succeeds to the Presidency of the Union. We are all aware of his very real achievements over the many years he has led this Committee and it is no exaggeration to say that the IUPAC publications we know today are for the most part the product of his own work. I invite you to show your appreciation of this, including at the same time, of course, the other Members of the Committee.

At the risk of taking advantage of your patience, I would now like to mention a few matters of a very general nature inspired by my observation of the functioning of the Union. In view of their generality it is unlikely that they can be used as the basis for immediate action, but they may be of use to our successors in the longterm development of IUPAC.

The first thing I noticed particularly during my two years is the fact that the Union's present structure does not seem to be adapted to the present situation of chemical science and its applications. The best way to make us realize this is to imagine for a moment that IUPAC does not exist and we have to create it ourselves. No doubt it would turn out very differently from our existing structure. IUPAC was originally designed along the lines of the clear distinctions which then existed in our discipline, particularly into inorganic, organic, and physical chemistry. This was, of course, with very good reason. Since that time, however, these fields have developed in such a way that the problems occupying us now are often less within the Divisions themselves than between neighbouring Divisions. Also, it is evident that the various nomenclature Commissions, those which establish standards, and those involved in documentation, often have far more affinity

with each other than with other Commissions in their own Divisions. It is obvious from the reports of our Commissions over the last twenty years that we have to counter this situation by exchanging representatives between groups which need to coordinate their actions or by setting up liaison committees. However, extending these procedures is not always efficient and can be both unwieldy and costly.

I appreciate that these remarks will seem to some of you to renege on the habits of half a century. However, I felt it necessary to broach the matter following discussions I had on interdisciplinary matters when I was Chairman of the *ad hoc* Committee on this subject set up by President A. L. G. REES during his term of office.

Another aspect of the life of our organization on which I have often meditated during my term of office and with which I would like to conclude is that of the faculty of IUPAC to adapt to evolution and growth. Everyone knows that in an organization like ours, it is easy to obtain general approval for creation of new bodies, but that it is very difficult to decide to abandon existing ones. The reason for this is that it takes far more courage to say 'no' than 'yes', particularly when the consequences involve our friends. Obviously, IUPAC's volume of activities has to be governed by financial considerations as in any other body. The adaptation of our organization to the evolution of science, both technological and social, involving us in adopting new objectives, must be accompanied by the relinquishing of others. I am not, of course, saying that whenever we decide to create a new body we must do away with another one of comparable importance, but I do hope that at all levels in our organization people will be aware of this necessity. An institution which does not have the strength to renew itself is an institution condemned at length to sterility. I hope that particularly in the field of applied chemistry a more flexible system will be progressively substituted for the much too rigid structure we have at present.

These are the reflections I wished to tell you about as my term of office as President draws to an end. They should not be interpreted as pessimistic, but on the contrary the expression of a wish to prepare our Union to meet the future as successfully as possible.

Finally, I would like to express my thanks to all those who have worked beside me during these two years, especially the Members of the Executive Committee and Bureau. I wish to mention particularly Dr. W. GALLAY, Secretary General, and Prof. O. HORN, Treasurer, with whom it has been a pleasure to collaborate. I also wish to mention our Executive Secretary, Dr. M. WILLIAMS, whose remarkable efficiency and devotion, as well as that of his staff at Oxford, is well known to all of us.

The shadow on all this is, however, the departure of Dr. REES, who after being a skilful and efficient President, has been at my side as Past-President. His advice has always been most welcome. I am sure his wide knowledge of international scientific affairs will often be put to good use in other places. I reiterate the thanks I made to him in Washington for the contribution he has made to our Union in past years.

I now turn to Sir HAROLD THOMPSON who will assume the Presidency at the end of this Council meeting. I express my best wishes for his success and the prosperity of IUPAC. It is a rare thing amongst us to find someone who

has been active in so many areas of our organization. There are very few of us who have such a deep knowledge and experience of the problems facing the scientific Unions in the world today. I feel, therefore, that I am placing IUPAC in good hands. It is up to you all, Members of Council, to facilitate his work by your full cooperation during his term of office.

J. BÉNARD
President

BIENNIAL REPORT OF TREASURER FOR 1971-2

The happy days when the income of IUPAC was higher than the expenses are unfortunately over. Increased financial burdens have arisen for the Union because of its extended activities, Interdivisional Committees, Sections, and other bodies. Anticipating that the subscriptions of the National Adhering Organizations would suffice no longer, a few years ago Lord TODD, Prof. W. KLEMM and Dr. R. MORF suggested that the status of Company Associates be created. One-third of our main funds now comes from that source: in 1972 some \$57,500 compared with \$114,900 from national subscriptions. Unfortunately, a number of countries whose chemical industry is large enough to afford such support of IUPAC, still have not joined the Company Associates scheme. From my own experience, I know that only personal contacts are successful in gaining Company Associates. My request is directed to you all: nobody should consider it too onerous to solicit new Company Associates. I should like to call your attention to Japan where, thanks to the endeavours of a few individuals, 35 Company Associates have been enlisted. Our President, Prof. BÉNARD, thanks to his personal efforts, too has recently succeeded in securing subscriptions for 12 units in France.

Concomitantly, a desire of long standing has been fulfilled, namely that of raising the interest of chemical industry in the activities of IUPAC. In this regard, Dr. R. W. CAIRNS, President of the Applied Chemistry Division, has done valuable work.

The Treasurer has been privileged to have the excellent support of the Finance Committee under the Chairmanship of Dr. J. W. BARRETT. Various measures helped towards improving our income. As it is based on the sales of the chemical industry in a particular country, the new structure for national subscriptions has resulted in a fairer rating of these subscriptions. However, the new structure has not brought in much higher revenue because, in accordance with the Statutes, selection of its category is at the discretion of each National Adhering Organization. Several countries are not in categories equivalent to their chemical turnover.

Consequently, the income of the Union has remained virtually unchanged for 3 years, although we are experiencing worldwide inflation which has inevitably affected IUPAC. Our budget is made out in US dollars and devaluation of the dollar has also led to a reduction in the assets and income of IUPAC. That is why it is necessary to obtain an increase in the income from national subscriptions as soon as possible.

When I was elected Treasurer in Washington 2 years ago, I had no notion of the exact financial situation of the Union at the time of assuming office, which took place during the Conference: no current statement was available at that time because we were in the middle of a financial year. I was very much surprised to see at the end of 1971 that we had closed our accounts showing a deficit of some \$50,300. The reasons are well known: more activities, the Conference held in a more expensive city, higher travel expenses.

In 1972 I had, therefore, to do everything in my power to place the finances on a balanced footing once again. As a consequence temporary cuts had to be made in the budget and I should like to take this opportunity to extend my heartfelt thanks to the Division Presidents for the understanding they showed and the assistance they have afforded me, so that it has been possible to close the accounts for 1972 with a good surplus of income over expenditures. I must

emphasize that the profit of over \$41,800 realized from sale of marketable securities is not a normal revenue item and, in any case, this has already been reinvested. In addition, I have permitted the carrying forward to 1973 of unused Divisional funds totalling \$13,100. Thus, the effective surplus of income against expenditures is only about \$22,100. The year 1972 is the first for which I assume full responsibility, in contrast to 1971 for which the present Treasurer can hardly be held responsible.

The question whether our journal *Pure and Applied Chemistry* and the Union's ancillary publications is a subsidized enterprise or shows a profit, has now been settled. A separate balance sheet for these publications, which was prepared at my request, has revealed that they have shown a good surplus, thanks to the efforts in particular of Sir HAROLD THOMPSON.

I have further good news for you. Following my personal call on the Swiss tax authorities, IUPAC is officially not subject to tax as from 1971, on condition that the registered office of the Union is in the Canton of Zürich. In connection with various double-tax treaties we have obtained tax rebates from Switzerland, UK, and USA. The royalties from our publications are now exempt from tax in UK.

It is gratifying also that many Members of our Committees and Commissions, as well as a number of Officers are able to charge up their IUPAC expenses to their employers. Several countries and firms bear in full or in part the costs incurred by their Titular Members and Officers, including office facilities, typing, post and telephone expenses. I am especially grateful to them for this substantial support.

Unfortunately, however, the Treasurer is not completely without worries. Some countries are rather slow in paying their annual subscriptions or are one year and more in arrears. The Treasurer can but send out reminders, which have often remained unanswered. The Finance Committee is endeavouring to help with suggestions for assuring a more punctual receipt of subscriptions. But I would appeal to the Delegations to support us in this regard in their respective countries.

I am well aware of the fact that the chemical industry and the academies and countries do not suffer from a surfeit of funds, but international cooperation should not be neglected. The proud edifice of IUPAC in which so many people work together voluntarily, giving up their own time and disclaiming payment, requires a foundation for its upkeep. I am indebted in this regard to Dr. M. WILLIAMS and Mr. R. J. M. RATCLIFFE and their coworkers at Oxford. IUPAC has available an excellent Secretariat whose assistance is always at your disposal.

Furthermore, I would extend my thanks to Schweizerische Bankgesellschaft whose facilities have always ensured excellent administration of our funds and the drawing up of our balance sheets in an exemplary manner, this having been done in the past by Mr. H. BAUMANN and Dr. J. RAKOWSKY, and since 1 March 1972 by Mr TH. FEHR.

I realize that our administration expenses are not cheap, but we do need an efficient Secretariat as a basis for our ramified organization, and a precise financial administration in Zürich so that you can see what happens to your money. I am pleased to report that both offices are doing outstanding work.

If worldwide inflation continues, we shall be able to absorb the rising costs only by increasing our income, unless our activities are to be curtailed. I am aware that our Divisions need more money and that we should make available more funds for symposia. But this will only be possible if we all make efforts towards finding ways of increasing the income of IUPAC, either by

obtaining new Company Associates or by raising further our national subscriptions.

We are grateful to ICSU for an annual grant of \$14,000 and also for a UNESCO teaching contract whose results were published in book form last year. We are especially indebted to Deutsche Forschungsgemeinschaft, Verband der Chemischen Industrie, the City of Munich, as well as several firms of the Bavarian chemical industry, who have supported our Munich Conference with a total of DM43,000, at a time when the Hamburg Congress required large sums from the German chemical industry.

Last, but not least, I would extend my thanks to my colleagues of the Executive Committee where the best way must often be sought in hard debate, so that the limited funds can be used to the maximum benefit of IUPAC. It is the task of the Treasurer to defend the funds against the many wishes that are expressed, so that money is always available when it is needed. Bearing this in mind, and with the support of all concerned, I hope I shall effectively fulfil the functions as Treasurer in the future too.

O. HORN
Treasurer

Zürich, 24 April 1973
Löwenstrasse 56

*To the Executive Committee
International Union of Pure and Applied Chemistry
Zürich—Switzerland*

AUDITORS' REPORT ON ACCOUNTS

Years ended 31 December 1971 and 1972

As auditors of the International Union of Pure and Applied Chemistry we have examined the accounts for the years ended 31 December 1971 and 1972 in accordance with the provisions of the law.

We have come to the conclusion that:

- the balance sheets and statements of income and expenses are in agreement with the books,
- the books of account have been properly kept,
- the financial position and the results of operations are presented in accordance with the principles of evaluation prescribed by the law and the requirements of the statutes.

As a result of our examination we recommend that the accounts submitted to you be approved.

Neutra Auditing Inc.

COMPARATIVE BALANCE SHEETS

(Expressed in

Assets

	1971	1972
Cash in Bank	40,832.99	82,298.27
Marketable Securities—at cost	203,883.85	242,401.69
Other Assets	1,079.70	0.00

245,796.54 324,699.96

Note: Subscriptions outstanding as at 31 December 1972 US-\$ 15,200.00

COMPARATIVE STATEMENTS OF INCOME AND

(Expressed in

Income

	1971	1972
<i>Subscriptions</i>		
Current Year	100,188.75	107,200.00
Previous Years	<u>5,750.00</u>	<u>7,700.00</u>
	105,938.75	114,900.00
<i>Company Associates</i>	54,029.65	57,554.18
<i>Interest and Dividends Earned</i>	9,015.43	9,059.60
<i>Publications</i>		
Butterworths	3,718.00	3,306.45
Secretariat	<u>2,371.15</u>	<u>4,389.85</u>
	6,089.15	7,696.30
<i>Other Income</i>		
USA—National Academy of Sciences	31,600.00	0.00
CEE Brussels	8,460.00	0.00
Gesellschaft Deutscher Chemiker (special subvention)	630.88	0.00
Reimbursement of Contributions 1970 and 1971 paid to ICSU	1,777.60	2,288.61
UNESCO Teaching Contract	<u>0.00</u>	<u>3,500.00</u>
	42,468.48	5,788.61
Profit on Sale of Marketable Securities	9,231.49	41,825.73
<i>Exchange Differences</i>	2,823.60	0.00
<i>Excess of Expenses over Income</i>	<u>50,311.68</u>	<u>0.00</u>
	<u>279,908.23</u>	<u>236,824.42</u>

AS AT 31 DECEMBER 1971 AND 1972

US-Dollars)

Liabilities and Net Worth

	1971	1972
Accrued Liabilities	800.00	2,661.52
Net Worth:		
Capital Account	<u>107,926.36</u>	<u>107,926.36</u>
Reserve		
Beginning of Year	187,381.86	137,070.18
Excess of Income (expenses)	<u>(50,311.68)</u>	<u>77,041.90</u>
End of Year	<u>137,070.18</u>	<u>214,112.08</u>
	<u>244,996.54</u>	<u>322,038.44</u>
	<u>245,796.54</u>	<u>324,699.96</u>

EXPENDITURES—YEARS ENDED 31 DECEMBER 1971 AND 1972

US-Dollars)

Expenditure

	1971	1972
<i>Office Expenses</i>		
General Office and Divisions	4,707.37	7,199.37
Office Secretary General		
(Zürich, Ottawa)	9,442.85	3,298.69
Secretariat Oxford	63,021.35	65,931.65
Audit, Bank Fees, and Other		
Charges	<u>7,328.01</u>	<u>7,533.88</u>
	84,499.58	83,963.59
<i>Travel and Subsistence Allowances</i>	18,538.84	61,110.78
<i>Special Account</i>		
(Washington Conference) ..	176,781.50	0.00
<i>Publications</i>		
Butterworths	759.40	0.00
Secretariat	<u>9,236.65</u>	<u>15,091.45</u>
	9,996.05	15,091.45
<i>Contributions to Symposia</i>	1,803.65	9,232.50
<i>UNESCO Teaching Contract</i>	<u>0.00</u>	<u>1,719.75</u>
	291,619.62	171,118.07
<i>Less: Subvention collected from</i>		
<i>from UNESCO/ICSU</i>	<u>14,000.00</u>	<u>14,000.00</u>
	<u>277,619.62</u>	<u>157,118.07</u>
<i>Contribution 1971 and 1972 to ICSU</i>	2,288.61	2,648.46
<i>Exchange Differences</i>	0.00	15.99
<i>Excess of Income over Expenses ..</i>	<u>0.00</u>	<u>77,041.90</u>
	<u>279,908.23</u>	<u>236,824.42</u>

INCOME OF IUPAC FROM NATIONAL ADHERING ORGANIZATIONS AND COMPANY ASSOCIATES IN 1972

Country	Category by Chemical Turnover	Category Chosen	National Contribution \$	Company Associates [¶] \$
Arab Republic of Egypt	D	C	450	—
Argentina	B1	B1	1,000 [†]	—
Australia	B1	B2	2,600	1,130
Austria	B1	C	600	—
Belgium	B2	B2	2,500 [‡]	1,065
Brazil	B2	C	400 [‡]	—
Bulgaria	D	C	400	—
Canada	B2	A1	6,400	—
Chile	—	D	100 [‡]	—
Colombia	C	C	400 [‡]	—
Cuba	D	D	100	—
Czechoslovakia ..	B2	B1	1,000	630
Denmark	B1	B2	2,500	—
Finland	C	B1	1,000	—
France	A1	B2	5,000	1,750
Germany	A2	A2	10,000*	8,648
Greece	C	D	100	315
Hungary	B1	B1	1,000	—
India	B2	B2	2,500	315
Ireland	C	D	200	—
Israel	C	B1	1,000	—
Italy	A1	A1	6,400 [‡]	1,574
Japan	A2	A2	6,600*	10,981
Mexico	B2	B1	1,000	—
Netherlands	B2	B2	2,500	—
New Zealand	B1	B1	1,000	—
Nigeria	D	D	100 [‡]	—
Norway	B1	B1	1,000	—
Poland	B2	B2	2,500	—
Portugal	C	C	400	—
Republic of China ..	C	B1	1,000	—
Republic of Korea ..	D	C	400	—
Republic of South Africa	B1	B1	1,000	315
Republic of Vietnam ..	D	C	400	—
Romania	B2	B2	2,500 [‡]	—
Spain	B2	B1	1,000	—
Sweden	B2	B2	5,000	315
Switzerland	B2	B2	2,500	—
Turkey	C	D	100	—
United Kingdom ..	A2	A2	10,000*	10,424
USA	A3	A3	25,000*	20,055
USSR	A2	A1	10,000	—
Venezuela	B1	D	100	—
Yugoslavia	B1	C	450 [‡]	—

* Made up to minimum subscription for relevant Category with subscriptions from Company Associates

[†] Partially outstanding as at 31 December 1972

[‡] Outstanding as at 31 December 1972

[¶] Including half contributions towards PAC subscription

FINANCE COMMITTEE

Report to Council

General Financial Position

Consideration of the trends shown by income and expenditure over the last decade clearly demonstrated that the Union was entering a period when a regular biennial excess of expenditure over income would occur and reserves would consequently decrease. It was to this problem that the Committee addressed itself primarily during the biennium. Some financial improvement had been achieved and more would result if recommendations were accepted.

Investment Income

The annual income rate from the investment portfolio would increase from \$9,000 in 1972 to at least \$14,000 in 1973 as a result of increasing our holding of bonds at the expense of shares but still maintaining more than 50% of the latter.

Budgetted Expenditure

It was recommended and agreed that the 1972 and 1973 budgets were amended by cuts in expenditure so that the estimate for 1972 showed a \$20,000 surplus and that for 1973 no more than \$20,000 deficit. The same practice had been recommended for the next biennium, namely to plan for a surplus in the non-Conference year of 1974 at least equivalent to any loss in the Conference year of 1975, such loss being not more than \$20,000. With the likelihood of continuing inflation, this demanded more income or further curtailment of activities.

Subscriptions from National Adhering Organizations

These made up our largest item of revenue but they had shown little increase during the last decade. The revised subscription scheme, recommended to and accepted by Council in 1971, rationalized the subscription payments but brought little real increase. It was now suggested that some modest increase in the national subscription rates must be agreed this year to become effective not later than 1975. Recommendations on how this should be done had been made to the Executive Committee. In addition, penalties for delayed subscription payments should be more severe and the minimum subscription should be increased to \$200.

Income from Company Associates

A modest increase in this income had been achieved despite the decline in the financial performance of the chemical industry in most countries. To facilitate the extension of the scheme to new countries and companies the Committee proposed the production of a brochure informative of the structure and activities of IUPAC. This had been done and the printed brochure distributed early this year to National Adhering Organizations, Members of the Bureau, and Company Associates.

Increase in Company Associates inevitably depended on the effectiveness and pertinence of the Union's scientific and technological programmes to the total needs of society including industry. A special meeting at Munich had been proposed to improve the knowledge of industry of IUPAC programmes and to discuss needs and objectives not at present worked on.

Other Sources of Income

It was suggested that grants from foundations were possible for some IUPAC projects and Division Presidents had been advised to bear this in mind when preparing programmes for 1974-5.

Control of Expenditure

The Committee had supported the Treasurer in his difficult but necessary task of controlling and reducing expenditures. It had emphasized that there were only two significant methods for counteracting the continuing rise in expenditure on meetings, namely minimizing travel costs and reduction of members eligible for expenses. In respect of the latter the Committee recommended that all methods should be pursued to extend participation of industrialists and others in IUPAC bodies without attracting travel and subsistence costs to the Union.

Publications Account

To ensure a common understanding of the important part that publications played in the Union, a separate formal financial publications account was recommended as soon as practicable. A trial run for 1971-2 showed the feasibility and usefulness of this procedure.

Membership

Prof. A. BJÖRKMAN (Denmark) and Dr. K. HOSHINO (Japan) replaced Dr. C. O. GABRIELSON and Prof. O. HORN, both of whom had completed eight years of service as Members. Under the new Standing Orders, Prof. Horn rejoined the Committee *ex officio* as Treasurer.

J. W. BARRETT

Chairman, Finance Committee

I. PHYSICAL CHEMISTRY DIVISION

Report of President

The reports from the six Commissions of the Division had revealed vigorous activities of various types. Noteworthy were: (a) formation of Sub-Commissions for the fields of Plasma Chemistry, Thermodynamic Tables, and Mass Spectroscopy, and also participation in *ad hoc* studies pointing to an Inter-Union Commission (IUB, IUPAB, and IUPAC) on Biothermodynamics; (b) leadership in securing adoption by CIPM of the unit mole as a seventh base unit of the SI and thus also securing recognition of derived molar quantities as parts of the SI; (c) continued production of detailed appendices (e.g., electrochemistry and colloid chemistry) for the 1969 IUPAC *Manual of Symbols and Terminology for Physicochemical Quantities and Units* (the Green Book); (d) fostering international communications in chemistry by means of conferences; (e) systematically developing standards and guidelines for the determination and publication of reliable data.

Commission I.1: Physicochemical Symbols, Terminology, and Units

SI Units. The Commission was pleased to report success in its efforts to secure inclusion of the unit mole (symbol *mol*) as the seventh base unit of the *Système Internationale d'Unités* by the XIV General Conference of Weights and Measures in 1971. Recognition of the mole as a base unit admitted derived units within the SI such as molar mass, molar concentration, molar entropy, etc.

In 1973 the International Bureau of Weights and Measures published a revised edition of *Le Système Internationale d'Unités* (SI). A joint translation of this edition into the English language had been published by NPL and NBS. Minor discrepancies had been noted between this new document on the SI and the IUPAC *Manual of Symbols and Terminology*. Consideration would be given to reducing these discrepancies in preparing for a needed reprinting of the Manual.

IUPAC Manual. Commission I.1 had continued productive collaboration with other Commissions of IUPAC in reviewing consistency of documents on symbols, terminology, and units prepared by those Commissions. Discussions had been held with Commissions I.2, I.3, I.5, I.6, V.5 and the Commission on Quantities and Units of the Section on Clinical Chemistry. An Appendix to the IUPAC Manual, entitled 'Definitions, Terminology, and Symbols in Colloid and Surface Chemistry—I', had been completed in definitive form by Commission I.6 and published in 1972. Part II was in preparation.

Quantum Chemistry. Interest had been expressed in the need for standardization of terminology and abbreviations for computation procedure used in quantum chemistry. The Commission had solicited comments through the *Quantum Chemistry Program Exchange Newsletter* (Indiana University, USA) and might sponsor a study group to draft recommendations.

Commission I.2: Thermodynamics and Thermochemistry

Publications. The 'Guide to Procedures for the Publication of Thermodynamic Data', first published in *Pure and Applied Chemistry* [29, 395 (1972)],

had been republished in five other journals in the English language, and in Japanese and French. Publications in German and in Russian were in preparation.

The *Bulletin of Thermodynamics and Thermochemistry*, initiated by the Commission, had become a very successful enterprise. An annual publication, it had increased significantly in size each year.

Conferences. The Sub-Commission on Plasma Chemistry (I.2.1) would hold a conference at Kiel, Germany on 6-10 September, 1973. The Commission (I.2), jointly with the Austrian Physical Chemistry Society, was sponsoring the III International Conference on Chemical Thermodynamics at Baden-bei-Wien on 3-7 September, 1973. Prof. F. KOHLER (University of Vienna) had made arrangements for the meeting and secured supporting funds from Austrian sources.

Collaboration with Other Commissions. Dr. J. D. Cox of the Commission had completed the chapter on 'Calibration and Test Materials in Calorimetry' for the volume on test materials in preparation by Commission I.4. The Chairman (Prof. F. D. ROSSINI) of the *ad hoc* Panel on Symbols and Terminology for Thermodynamics had prepared a progress report for discussion at Munich. The aim was to provide somewhat more detail for thermodynamic quantities than was given in the *IUPAC Manual of Symbols and Terminology*.

Thermodynamic Tables Project (Imperial College, London). A Sub-Commission on Thermodynamic Tables (I.2.2) had been established to provide more effective guidance for the Project which was now becoming very productive. The first volume of the series *International Thermodynamic Tables of the Fluid State*, entitled 'Argon 1971', was published in 1972; the second book, 'Ethylene 1972', was in press. Similar tables for carbon dioxide and helium had been completed and were being reviewed critically by their respective panels.

Collaboration with CODATA. It was anticipated that the second and third *Tables of Key Values for Thermodynamics*, prepared by the CODATA Task Group on Key Values, would be approved at the Munich meeting for use by chemists.

Inter-Union Commission. Dr. I. WADSÖ of Commission I.2 had chaired an Inter-Union (IUB, IUPAB, IUPAC) *ad hoc* Committee aiming to establish an Inter-Union Commission on Critical Compilation of Thermodynamic Data for Biochemical Processes and Reactions. Recommendations for the formation of such a Commission had been formulated for presentation to the Bureau for approval at Munich.

Commission I.3: Electrochemistry

Recommendations. The main recent activity had been preparation of the draft document 'Electrochemical Definitions and Symbols', which would eventually become one of the Appendices to the *Manual of Symbols and Terminology*. After extensive circulation and discussion within the Commission the document was published in November 1972 as Tentative Nomenclature Appendix No. 28 to the *Information Bulletin*.

Tables of Data. As part of the effort of the Commission to stimulate preparation and publication of tables of data, Dr. R. TAMAMUSHI had published in *Electrochimica Acta*, as a preprint to the final document, 'Kinetic Parameters of Electrode Reactions'. This manuscript would be discussed at the Munich Conference.

Commission I.4: Physicochemical Measurements and Standards

Vapour Pressure of Water. The Commission had continued to act in liaison between laboratories interested in measurements of the density and vapour pressure of water.

Calibration and Test Materials. The 'Catalog of Physicochemical Standard Substances', previously published in tentative form, had now appeared in *Pure and Applied Chemistry* [29, 597 (1972)]. During the past 2 years the emphasis of the Commission's work had been on the programme to formulate recommendations for calibration and test materials for a wide variety of physicochemical measurements. This programme was under the aegis of the new Sub-Commission on Calibration and Test Materials (I.4.1). This group met at Zeist, Netherlands, in June 1972 and assigned responsibility for each measurement to a small panel of experts. The measurements and panel Chairmen were: density (BROWN); viscosity (SMIT); surface tension (BROWN); PVT properties (AMBROSE); calorimetry (COX); thermal conductivity (BRUNNER); distillation column performance (KIENITZ); optical properties (BROWN); dielectric constants (KIENITZ); potentiometric ion activities (CALI); temperature test materials (SMIT); and molecular weight (SIMON). Since the Zeist meeting a number of the documents on individual properties had been drafted. At Munich there would be discussion of the appropriate mode of publication of the results of this large enterprise.

Commission I.5: Molecular Structure and Spectroscopy

Publications. Parts III and IV of 'Tables of Wavenumbers for the Calibration of Infrared Spectrometers' ($600\text{--}1\text{ cm}^{-1}$) appeared in *Pure and Applied Chemistry* [33, 605 (1973)]. 'Recommendations for the Presentation of NMR Data for Publication in Chemical Journals' were published in *Pure and Applied Chemistry* [29, 625 (1972)]. Comments received on the tentative 'Recommendations for the Presentation of Raman Spectra for Cataloging and Documentation in Permanent Data Collections' were being incorporated in the document as appropriate. The revised document would be submitted for approval at the Munich Conference.

Sub-Commission on Mass Spectroscopy. Dr. J. H. BEYNON, a new Titular Member of Commission I.5, was the Chairman of the new Sub-Commission which hoped to meet at Munich.

Inter-Union Commission on Spectroscopy. IUPAC had four Members on this ICSU body. Profs. A. R. H. COLE and Y. MORINO had been nominated to replace Profs. R. C. LORD and H. W. THOMPSON whose terms had expired. Prof. V. A. FASSEL and Dr. R. N. JONES were the other two IUPAC Members.

Current Activities. These included the following: (a) Revision of Parts I and II of 'Tables of Wavenumbers for the Calibration of Infrared Spectrometers' ($4300\text{--}600\text{ cm}^{-1}$). Sales had been heavy and a new printing was necessary. Under consideration were the needs for revisions and additions, and the incorporation of new material for $600\text{--}1\text{ cm}^{-1}$ in one volume. (b) Extension of the NMR recommendations to nuclei other than protons. (c) Nomenclature and conventions for reporting Mössbauer spectroscopic data. A document on this topic had received extensive revision and was nearly ready to publish as a Tentative Nomenclature Appendix to the IUPAC *Information Bulletin*. (d) Presentation of spectral data on photoelectron spectroscopy. (e) 'Recommended Names and Symbols for Light and Related Electromagnetic Radiation' (Tentative Nomenclature Appendix No. 24 to

the *Information Bulletin*, June 1972): there were still some details of these tentative recommendations that were receiving attention in cooperation with Commission I.1.

Commission I.6: Colloid and Surface Chemistry

Recommendations. Part I of the *Manual of Definitions, Terminology, and Symbols in Colloid and Surface Chemistry*, which was approved for publication at Washington in July 1971, was subjected to final editorial amendment and published in *Pure and Applied Chemistry* [31, 577 (1972)], as Appendix II to the IUPAC *Manual on Symbols and Terminology*.

Part II of the Manual, which dealt with heterogeneous catalysis, would be presented for approval as a tentative recommendation at Munich. Additional parts dealing with (a) electrochemical terms in colloid and surface chemistry, (b) light scattering, and (c) rheology, would be added.

Proposed recommendations for the nomenclature of zeolites and molecular sieves were being prepared in consultation with outside experts.

The Commission, at the request of CODATA, would draft recommendations for the presentation of quantitative numerical data in its area of expertise.

Education. Contributions for a resource book on colloid and surface chemistry for those teaching standard physical chemistry courses had been received and edited. Plans for printing and distribution would be discussed at Munich.

Standard Samples. The cooperative project with the British Society of Chemical Industry had gone through the stage of analysis of the data collected from the cooperating laboratories. Samples had been made available for general distribution.

G. WADDINGTON
President, Physical Chemistry Division

II. INORGANIC CHEMISTRY DIVISION

Report of President

The Officers of the Division had met in Vienna in May 1972 to discuss current business matters, such as recommendations on the granting of sponsorship of the Union to symposia, meetings of the Commissions in 1973, purchase of reprints of Commission reports in *Pure and Applied Chemistry*.

Commission II.1: Atomic Weights

Four years ago the Commission completed a reevaluation of the published experimental evidence for all values in the Table of Atomic Weights [*Pure Appl. Chem.*, **21**, 95 (1970)]. The special aim was to present these values in a statistically sound and consistent manner. This purpose could only be attained by making small adjustments to most atomic weight values. The secondary adjustments which had been proposed in 1971 [*Pure Appl. Chem.*, **30**, 637 (1972)], had been very few and had all originated from within the Commission. No major errors of judgment had since come to light. It was concluded that this phase of the Commission's work had been satisfactorily completed. The new values were evidently well received throughout the chemical profession.

Adjustment of values in the issued Table of Atomic Weights was a never-ending task for the Commission. The need for new and significant experimental values was again very pressing, especially for elements such as Ga, Ge, K, Pd, and Se. Because the atomic masses of individual nuclides were relatively well known, the key to most atomic values was the isotopic abundance. The Commission was embarking on a major assessment of available techniques for atomic weight or abundance measurements. Physical methods at one time and to some experts appeared to have replaced chemical techniques completely. The Commission during the past two years had come to realize that chemical methods, especially if one included electrochemical techniques, were by no means out of contention. Critical review of all these techniques also was a never-ending task for the Commission.

The last and perhaps most significant recent development for the Commission's work resulted from nuclear engineering being practiced on an ever larger and more diversified industrial scale. To the atomic weights specialist the discovery of isotopes around the turn of the century was a conceptionally significant event. However, atomic weights remained constants for all practical purposes. As industrial processes were gradually being developed that turned out products of altered isotopic composition, more and more materials were reaching markets and laboratories for which the accepted atomic weight value would not apply within the ranges of normal uncertainties. The Commission in this present era saw as its principal challenge to prepare the chemical public for the fact that atomic weights were not necessarily constants for every element. An atomic weight value should at times be regarded as a characteristic only of a particular specimen or homogeneous product.

During the two years under review the Commission had been working on the footnotes to the issued Table of Atomic Weights. It was in these footnotes that chemists would find all necessary warnings of materials having unusual isotopic compositions.

Commission 11.2: Nomenclature of Inorganic Chemistry

The second edition of *Nomenclature of Inorganic Chemistry* (the Red Book) had now appeared both in *Pure and Applied Chemistry* [28, 1 (1971)] and as a separate volume. Extended rules for the 'Nomenclature of Inorganic Boron Compounds' had also appeared in *Pure and Applied Chemistry* [30, 681 (1972)]. Satisfactory agreement was reached, at a meeting in London in October 1971, by the *ad hoc* subcommittee set up with the Commission on Nomenclature of Organic Chemistry to finalize the tentative version of rules for organic derivatives of the elements which would appear eventually as *Nomenclature of Organic Chemistry, Section D*. The Commission was considering by correspondence names for elements 104, 105, *etc.*; nomenclature of ring and chain compounds; and the table of names for ions, radicals, *etc.* Various smaller groups mentioned in the minutes of the Washington meeting were at work by correspondence.

Commission 11.3: High Temperatures and Refractory Materials

A very successful Commission meeting was held in Paris during October 1972. This was held without financial support from IUPAC. There were 14 attendees: 5 (of the 6) Titular Members, 3 Associate Members, and 4 National Representatives. Permission to increase membership to the statutory limit of 8 Titular Members and 8 Associate Members had been requested.

The number of subscribers to the *High Temperature Bibliography* had remained at about the previous year's figure of 400. The publication still showed a financial deficit but this had decreased due to personal donations. The subscription had been raised by 40% in British currency and an adjustment had been made in the US dollar evaluation. Complete recovery of the deficit would have required much more drastic action. This had been avoided by withdrawing the publishing operation from a commercial firm and transferring it to Imperial College, London. This had reduced production costs and decreased the publishing time as well. There were now 21 honorary compilers in 14 countries and it was on the generous efforts of these and the editor, Dr. M. G. HOCKING, that the Bibliography depended.

On behalf of the Commission Prof. M. FOEX (France) had assembled a new Project Group for Melting Points. There were now 10 members representing 6 countries. Specimens from the same batch of yttrium oxide, prepared at Odeillo, had been distributed. Results were expected within the next one or two years.

Reports for the Vapour Pressure Standards gold, silver, and cadmium, had been published [*Pure Appl. Chem.*, 31, 371 and 395 (1972)]. Data from some laboratories had been received for platinum, but other urgent duties of Dr. R. C. PAULE, the project coordinator, had prevented completing the evaluation and writing of the report. Only the US National Bureau of Standards had attempted work on tungsten and a technical article by E. R. PLANTE and A. B. SESSOMS had been published. However, the Project Group would not recommend tungsten as a vapour pressure standard because of the lack of other data. Upon the completion of the report on platinum, the Project Group would be dissolved. Compounds as standards, in contrast to elements, might be considered by the Commission at some future time.

The paper 'Limitations in Applying Mass Spectrometry to High Temperature Equilibrium Studies' by Prof. F. E. STAFFORD had been published

[*High Temperatures—High Pressures*, 3, 213 (1971)]. This was in accord with discussions at the July 1971 meeting of the Commission.

The Symposium on Physicochemical Techniques at High Temperature, chaired by Prof. C. B. ALCOCK, had suffered uncertainty due to an unexpected conflict with the III International Conference on Chemical Thermodynamics (Commission I.2). This had now been cleared up and the two meetings would be held jointly at Baden, near Vienna, during 3-7 September 1973. This moved the High Temperature Symposium out of the XXIV IUPAC Congress, a fact that both the Commission Chairman and Prof. ALCOCK greatly regretted and which had caused a mild embarrassment with the Gesellschaft Deutscher Chemiker. The plans were now firm and there would be about 40 papers including plenary lectures. The main purpose of the Symposium was to search out areas of future work for the Commission, and a special session would be devoted to this particular subject.

The idea of a monograph on the nomenclature and characterization of materials containing essentially only carbon had been presented to carbon organizations in Germany, France, Japan, UK, and USA. These organizations agreed that standardization of nomenclature would be of foremost value, with some coordination of characterization methods of next importance. A Project Group with at least one member from each of these countries would be chosen. Prof. E. FITZER would act as the coordinator of these carbon experts for the purpose of putting together a recommended nomenclature.

Prof. G. D. RIECK, Secretary of the Commission, had contacted Officers of IUCr at its 1972 Tokyo meeting. A new Commission on X-ray Diffraction under Extreme Conditions was formed by IUCr with Prof. FOEX as Chairman. The Commissions of the two Unions would maintain liaison through Prof. R. COLLONGUES, and a joint effort on high temperature X-ray diffraction was planned.

O. GLEMSE
President, Inorganic Chemistry Division

III. ORGANIC CHEMISTRY DIVISION

Report of President

The Organic Chemistry Division had continued its work through its three Commissions and Section and by organizing symposia. The period under consideration had seen the first beneficial results of a new policy for symposia, delineated by the Division Committee as early as 1969 and now in operation.

In recent years the policy of the Division had been to set up a worldwide series of symposia of two types: highly specialized ones at irregular intervals, and serial ones covering wider areas. The Symposia on the Chemistry of Natural Products were the first series to be regularly organized, every second year. The VIII Symposium was held in New Delhi in February 1972. In July 1972 the IV Symposium on Photochemistry took place in Baden-Baden, and in September 1972 in Crans-sur-Sierre the I Conference on Physical Organic Chemistry, for which the Division Committee could claim to have taken the initiative. The I IUPAC Conference on Synthetic Organic Chemistry, which the Division Committee had also fathered, would be in Louvain in August 1974 and it would complete for the time being the envisaged serial symposia.

Specialized symposia were, of course, very varied, and some showed a tendency towards recurrence (e.g., III Carotenoids and VI Carbohydrates, both of which were also held in 1972). During July 1972, another type of symposium was tried, the IUPAC Symposium on Chemistry in Evolution and Systematics in Strasbourg. It was the most interdisciplinary meeting in which the majority of the participants had taken part: botanists, entomologists, and geologists met with chemists and found a common language. This might encourage other attempts at bridging gaps.

However, it must be stressed that while IUPAC sponsorship might in some countries help the organizers to obtain local funds, the restrictions presently placed on IUPAC subventions might force the Division to abandon its policy of actively suggesting symposia to potential organizers, at a great loss to the international distribution of chemical meetings. That was why the Division Committee had felt forced to undertake a policy of requesting in several cases the help of IUPAC in the form of "deficit guarantees" rather than simple subventions.

The reelection of Prof. P. YATES (Canada) to Membership of the Division Committee at the XXVI IUPAC Conference (1971) was not accepted by the Bureau for statutory reasons. He had, therefore, been invited to take part in the Committee's work as a Coopted Member.

Commission III.1: Nomenclature of Organic Chemistry (CNOC)

The main activity had been centred on finalization of the manuscript of the tentative version of Section D (organic compounds containing elements which are not exclusively carbon, hydrogen, oxygen, nitrogen, halogen, sulfur, selenium, and tellurium) of *Nomenclature of Organic Chemistry* (the Blue Book). This task proved to be more difficult than expected for various reasons. First, in some particular cases the points of view of inorganic and organic chemists had to be adjusted, mainly for the definitions and expressions of valence and related concepts. Second, the various subsections of Section D had been originally written independently and quite a lot of editing was necessary to produce a consistent document.

During the XXVI IUPAC Conference, because of disagreement with the Commission on Nomenclature of Inorganic Chemistry (II.2), it was decided to postpone the adoption of Section D as tentative recommendations issued by IUPAC and to create an *ad hoc* subcommittee composed of Prof. J. CHATT and Prof. J. E. PRUE (Commission II.2) and of Dr. L. C. CROSS and Prof. N. LOZAC'H for CNOC. This subcommittee met in London during October 1971 and was able to find a compromise for all the questions which had led to difficulties.

After the London meeting, production of the text for Section D was begun and all secondary problems were settled during the meeting of CNOC in Villefranche-sur-Mer during September 1972. The larger part of the latter meeting was in fact necessary for a careful review of the whole document. The final drafts for subsections 0-5 and appendix were then prepared by Prof. N. LOZAC'H, while Dr. L. C. CROSS prepared subsections 6-7. Publication of Section D was expected in August 1973 as Tentative Nomenclature Appendix No. 31 to the *Information Bulletin*.

The next meeting of CNOC, in Wurzburg during August 1973, would deal with such items as finalization of various documents (including Section E); general rules for natural products and their derivatives; rules for specialized areas of natural products—special organic nomenclatures (cyclophanes, cage compounds, etc.).

Another important topic would be to discuss the principles underlying future activity of the Commission and more precisely the influence of machine documentation on the future evolution of nomenclature.

'Definitive Rules for Nomenclature of Steroids', prepared jointly with the IUPAC-IUB Commission on Biochemical Nomenclature (CBN), had been published in *Pure and Applied Chemistry* [31, 283 (1972)]. The tentative version of 'Rules for Nomenclature of Carotenoids', also prepared jointly with CBN, had appeared as Tentative Nomenclature Appendix No. 19 (February 1972) to the *Information Bulletin*.

CBN, which was attached jointly to the Organic Chemistry and Macromolecular Divisions in the case of IUPAC, had issued 'Nomenclature of Multiple Forms of Enzymes' and 'Symbols for Amino-Acid Derivatives and Peptides' as Tentative Nomenclature Appendices Nos. 22 and 23 (June 1972), respectively, to the *Information Bulletin*. 'Nomenclature of Iron-Sulfur Proteins' was due for publication shortly as Tentative Nomenclature Appendix No. 32 (August 1973). In addition, the following definitive (final) recommendations had been published in *Pure and Applied Chemistry*: 'A One-letter Notation for Amino-Acid Sequences' [31, 639 (1972)]; 'Definitive Rules for Naming Synthetic Modifications of Natural Peptides' [31, 647 (1972)]; 'Abbreviated Nomenclature of Synthetic Polypeptides (Polymerized Amino Acids)' [33, 437 (1973)]; 'Definitive Nomenclature for Vitamins B-6 and Related Compounds' [33, 445 (1973)].

Commission III.2: Chemical Taxonomy

The two main concerns had been the organization of the Symposium on Chemistry in Evolution and Systematics and the relationship of the Commission with other bodies. The Symposium was an unqualified success in spite of a rather low attendance (about 120 participants). The interest and general high level of discussion between the participants representing several different disciplines was remarkable, and pointed to the need for some continuing organization to plan further meetings of this sort. Attempts by the

Commission to work towards this end through an *ad hoc* (IUPAC-IAPT) Committee for International Organization for Chemosystematics had been somewhat frustrated by the fact that the Committee had so far been unable to meet and that attempts to engender support through circulation of the aims of the *ad hoc* Committee in a large number of periodicals and to a number of national societies had not elicited any new support in strength: it remained enigmatic whether anything further could be done in this way. The Commission had, therefore, recommended dissolution of the *ad hoc* Committee and fostered the formation of a new Committee, which would be independent of IUPAC and IAPT: it would consider continuing and extending the work of the Commission, especially in regard to the organizing of symposia of the Strasbourg type.

Members of this new Committee on Communication among Chemotaxonomists were: Prof. N. FARNSWORTH (Chicago), Prof. W. F. GRANT (Quebec), Dr. J. B. HARBORNE (Reading), Prof. T. J. MABRY (Austin), Dr. J. A. MEARS, Acting Chairman (Philadelphia), Prof. E. SCHOFFENIELS (Liège). It was planned to meet in Lidingö near Stockholm during August 1973 during the Nobel Symposium on Chemistry in Botanical Classification. In addition, those Members who would be in Boulder, Colorado (ICSEB) in mid August 1973, would meet for informal discussions. The Committee had explored the possibility of a new publication to cover reports of natural products in plants but concluded that Prof. FARNSWORTH's pharmacological index, *Pharmacognosy Titles*, sufficed. The agenda for the meeting in Lidingö included determining the role of the *Chemical Plant Taxonomy Newsletter* as a nucleus for an international organization. The Newsletter which was sponsored by Commission III.2 and presently edited by Dr. MEARS, was distributed to more than 425 addresses, including at least 10 libraries. Its continued publication was also now assured.

The problem of publications in the field had been somewhat alleviated by the publication in part of the *Scott-Devon Index of Natural Products*, but although it was of use to chemists it was of little value to chemotaxonomists. For several years the Commission had urged that a new journal *Biochemical Systematics* should be published, and in 1973 the birth of such a journal finally occurred.

The Commission would meet in August 1973, during the IUPAC Conference in Munich, in order to finalize its business.

Commission III.3: Organic Photochemistry

The first meeting of the reorganized Commission took place during the IV Symposium on Photochemistry. The report of the previous Membership (Hammond Commission) was considered at some length. The arguments presented by Prof. G. S. HAMMOND that organic photochemistry should not operate in isolation from other related areas (inorganic photochemistry, photophysics, photobiology, and theoretical chemistry) were regarded as sound. The new Members did not, however, share the conclusion that there was no need for a Commission on Organic Photochemistry. In fact it, was concluded that in the near future IUPAC might form an Interdivisional body devoted to photochemistry as a science with appropriate subgroups.

Fundamentally, the Commission saw itself as a bridge between organic chemistry and photochemistry. Its aims were:

- (i) Promotion of symposia which stimulated the development of photochemical knowledge and provided a forum for discussion of current problems.
- (ii) Coordination of photochemical meetings sponsored by IUPAC and other agencies.
- (iii) Education of organic chemists in the photochemical expertise required for utilization of photochemical techniques in laboratory and industrial synthesis.
- (iv) Recommendation of standard nomenclature for the photochemical literature. This function should be performed in conjunction with other areas of photochemistry, especially photophysics and photobiology.
- (v) Education of graduate and postdoctoral students in the science of photochemistry.

Vigorous support of the highly successful IUPAC-sponsored symposia initiated in 1964 by Prof. HAMMOND would contribute to goals (i), (iii), and (v). Organization of symposia at IUPAC Congresses would also contribute to these goals, especially (iii) and (v). The Hammond-initiated symposia were devoted to photochemical problems and properly dealt with all areas of photochemistry. The symposia held at IUPAC Congresses were part of the Organic Chemistry Division and should reflect this interest in selection of the programme. It was hoped to organize a symposium for the XXV IUPAC Congress (1975).

It was recommended that the Commission be expanded from four to six Titular Members, Prof. T. MUKAI (Japan) and Dr. A. LAMOLA (USA) being suggested for the new positions. Prof. MUKAI's appointment would recognize the rapidly developing interest in organic photochemistry in Japan; Dr. LAMOLA's appointment would provide the Commission with expertise in these areas of organic photochemistry which overlapped with photobiology.

Section III.4: Medicinal Chemistry

Concern of the Section for proper international nomenclature to be used by WHO in reference to nonproprietary drugs had led to a meeting between its Chairman, Prof. E. CAMPAIGNE, and Dr. O. WALLEN, Chief Pharmaceutical Officer of WHO, in September 1971 in Washington, DC. It was anticipated that much of the problem might be eliminated by informal exchange of information between Dr. C. T. VAN MATER, who prepared the chemical names for WHO's 'International Nonproprietary Names for Pharmaceutical Substances', and Dr K. L. LOENING, of Chemical Abstracts Service, who also represented IUPAC nomenclature interests.

A major activity during this two year interval had been the continual publication of a biannual newsletter. The Secretary, Dr. A. I. RACHLIN, had borne the brunt of this effort and it had proved to be extremely interesting, not only to Members of the Section, but also to national medicinal chemical groups. It had been particularly helpful in those areas where new national sections of medicinal chemists were being formed. The newsletter had provided a means of exchanging information between the sections, and also supplying the names of active medicinal chemists in other countries. Other aspects of communication between medicinal chemists in the several countries had also been pushed in other ways. Various international meetings of interested medicinal chemists were listed in each newsletter. Since the Washington meetings Dr. RACHLIN had initiated a column, entitled 'First Intro-

duction of New Single Drugs in England, France, Germany, Italy, Japan, Switzerland, and the United States'. In this work he had been aided by Mr. P. DE HAEN of Paul De Haen, Inc. This column listed the structural formula of each new chemical entity introduced as a drug, as well as the generic name, the inventor and marketer, and pertinent references. It was hoped that in this way a major communication barrier might be overcome.

Also introduced was a new column involving surveys of items from WHO publications, with special emphasis on potential research areas of interest to medicinal chemists. It was hoped that this initiative of IUPAC would focus attention on serious medical problems which might be solved by chemical approaches. The Secretary was aided in this work by one of the Section's Members, Prof. A. ALBERT. By listing the meetings of major interest to medicinal chemists, it was hoped to provide some guidance in the development of programmes, and the prevention of overlap and duplication in the area of international meetings in medicinal chemistry.

The ICSU Scientific Committee on Problems of the Environment (SCOPE) met in Canberra in September 1971. Prof. ALBERT attended the meeting and reported on the relative interest of the Section in this area. The outcome was that Prof E. J. ARIËNS would prepare a short statement on toxicity for publication in the Section newsletter, because this impinged on the environment.

The Section's *ad hoc* Committee on Symposia and Meetings had continued to be active, corresponding with a variety of national groups which proposed to sponsor medicinal chemistry meetings. The Committee attempted to provide some guidance and some exchange of information to prevent overlap and duplication.

The *ad hoc* Committee on Education continued to be active under the chairmanship of Prof. E. E. SMISSMAN. It was assembling a report which would be presented for final approval at Munich in August 1973. It was hoped that when final approval was gained, the education report for medicinal chemists could be published in some regular publication of IUPAC.

The Section met in formal session at Milan during September 1972. Included in the discussions were the matters of nonproprietary names, the CODATA questionnaire from Prof. W. KLEMM, the problems of an international medicinal chemistry award, liaison with national organizations, and correspondence for the newsletter, and reports from Prof. ALBERT on SCOPE, from Prof. ARIËNS on meetings and symposia, from Prof. W. TH. NAUTA on education, matters of the next business meeting, election of Officers and new Members, and the Section's finances.

G.OURISSON
President, Organic Chemistry Division

IV. MACROMOLECULAR DIVISION

Report of President

The Division had sponsored the International Symposium on Macromolecules in Helsinki during July 1972. That particular meeting was divided into 5 sections with 30 main lectures and a large number of short communications. The general opinion was that the Symposium had been very successful, but it was perhaps too luxurious. The Division had also collaborated in the II Discussion Conference on Macromolecules (Prague, August 1972), the theme being 'Macromolecular Matrices and Carriers of Biological Functions'.

As regards Microsymposia, the Division had sponsored the following:

- VIII Prague Microsymposium: Morphology of Polymers (August/September 1971)
- IX Prague Microsymposium: Thermodynamics of Interactions in Polymer Solutions (September 1971)
- Photochemical Processes in Polymer Solutions (Louvain, June 1972)
- X Prague Microsymposium: Conformational Structure of Polymers (August 1972)
- XI Prague Microsymposium: Mechanism of Inhibition Processes in Polymers—Oxidation and Photochemical Degradation (September 1972)

During the Helsinki Symposium the Division Committee met twice. Future International Symposia on Macromolecules were planned as follows:

- Hamburg, September 1973
- Aberdeen, September 1973
- Rio de Janeiro, July 1974
- Madrid, September 1974
- Japan, 1977

In addition, the following Microsymposia were organized:

- Progress and Future of Macromolecular Science: High Tatras, May 1973
- Organized Structures in Polymer Solutions and Gels: Prague, August 1973
- Transformations of Functional Groups on Polymers: Prague, August 1973

The Working Party on Molecular Characterization of Polymers had met in Strasbourg (November 1971) and in Brussels (November 1972). A multi-laboratory programme was being undertaken on degree of branching in low and high pressure polyethylene. A change in name had been agreed for the other Working Party of the Division, viz. from 'Relationship of Performance Characteristics to Basic Parameters of Polymers' to 'Structure and Mechanical Properties of Commercial Polymers'. This Working Party had met four times since the XXVI IUPAC Conference: Antony (Seine) in November 1971, Bollate in May 1972, Lyon in September 1972, and Frankfurt/Main in February 1973. A second report on 'A Collaborative Study of the Dynamic, Mechanical, and Impact Properties of PVC' was under publication in *Pure and Applied Chemistry* [the first part appeared in *Pure Appl. Chem.*, **18**, 553 (1969)].

The Division had been asked to consider reconstituting its two Working Parties as Commissions. Thus, Council at Washington in 1971 had approved

the appointment of an *ad hoc* Committee to study the need for a Commission on Molecular Characterization of Polymers. However, the Division Committee had now concluded that the requested transformations were not in the best interests of IUPAC; the present efficiency of working might be endangered and Commissions required budgetary provision from IUPAC for their meetings. This conclusion was accepted by the Bureau.

The statement that the Division did not wish to form Commissions based on particular industrial fields had been reaffirmed. This meant that the Section on Organic Coatings could not be transferred in its present form from the Applied Chemistry Division to the Macromolecular Division.

Commission IV.1: Macromolecular Nomenclature

The Commission met during June 1972 at Knokke-Zoute. The document 'Nomenclature of Regular Single-strand Organic Polymers' was finalized for publication as Tentative Nomenclature Appendix No. 29 (November 1972) to the *Information Bulletin*. Discussion of 'Tentative Rules for Stereochemical Nomenclature of Polymers' had reached an advanced stage and should be concluded at the XXVII IUPAC Conference (1973).

H. BENOÎT
President, Macromolecular Division

V. ANALYTICAL CHEMISTRY DIVISION

Report of President

Two cuts in the allocation of funds for the Division in 1972 necessitated the cancellation of some Commission meetings and restriction of attendance at others. With the generous aid of various organizations, however, it was possible for useful meetings to be held by the Division Executive Committee and Commissions V.1, V.3, V.6, and V.7. In spite of the restrictions in meetings, the activity of the Division had continued at a high level. Since the XXVI IUPAC Conference, 13 reports had been published, 9 tentative reports reproduced as Appendices to the *Information Bulletin*, and a further 8 reports were at various stages of processing for publication.

Progress had been made in collaboration with ISO, particularly ISO/TC 47 (Chemistry). Increasing numbers of draft ISO Recommendations were being received for comment and this had laid a considerable extra burden on Members of the Division. A representative of the Division attended the ISO/TC 47/SC 3 (Reagents for Chemical Analysis) meeting in 1972.

Commission V.1: Reactions and Reagents

Work had continued, in collaboration with Section VI.1, on analytical methods for control of food additives in fulfilment of the IUPAC-CEE contract. During 1971, 23 methods were prepared and, in 1972, 43 methods including some revisions. These methods had been forwarded, through the IUPAC Coordinating Committee to CEE. Methods for the 1973 contract were under review.

The more traditional work of the Commission was resumed in 1971 and a report on methods for determination of phenols had been produced. A report on identification and determination of amines was nearing completion and projects on redox indicators and identification and determination of amines were in progress.

The Commission had been heavily engaged in consideration of draft ISO Recommendations.

Report: A Survey of some Recommended Methods for Identification and Determination of the Phenol Group: Technical Report Appendix No. 7 to *IUPAC Inf. Bull.*, August 1973

Commission V.2: Microchemical Techniques and Trace Analysis

Four of the Commission's projects on organic microanalysis were expected to be completed in 1973—determination of fluorine, of metals, and of carbon and hydrogen in compounds containing heteroelements, and the expression of errors in organic analysis. The first stage of the fifth project, determination of carbon, hydrogen, and nitrogen in organometallic compounds, had been completed and the second (experimental) stage was being planned.

A study on mass absorption coefficients used in electron beam microanalysis was expected to be completed in 1973.

The Commission's projects on trace analysis were making good progress. There were three current projects under the general heading 'Trace Analysis Applicable to the Determination of Minor Impurities in Chemicals'; the first report, a general survey, had been translated into English and was in

the final stages of Division approval; a report on trace impurities in oxygen and helium was expected soon and work on trace analysis of high-purity mineral acids was proceeding. A report on the availability of standards for trace analysis had been written; progress of a project on the evaluation of methods of calibration in trace analysis would be discussed at the Conference in Munich. Information had been collected and summarized on methods used in various countries for destruction of organic matter for preconcentration of trace elements.

Reports: Erreurs en Microanalyse Organique Elémentaire: *Pure Appl. Chem.*, **29**, 409 (1972); **29**, 629 (1972); **30**, 301 (1972)
Study on Purification of Chemicals for Trace Analysis: *IUPAC Inf. Bull.*, Nos. 42/43, July 1972, pp. 23-26

Commission V.3: Analytical Nomenclature

Five projects reached the stage of publication as tentative reports (see below). Comments were considered at the Commission meeting in November 1972 and finalized reports on contamination phenomena, chromatography, thermal analysis, and mass spectrometry were being considered by the Division Committee. The report on scales of working was being revised in the light of comments received. Draft reports on the use of the concepts of normality and molarity and on trivial names and synonyms of analytical reagents would be reviewed at the Conference. Projects on the presentation of analytical papers for publication and on kinetic methods of analysis were making progress.

Reports: Recommendations on Ion Exchange Nomenclature: *Pure Appl. Chem.*, **29**, 617 (1972)
Appendices to the *Information Bulletin*, February 1972—
No. 14 Recommendations on Nomenclature for Contamination Phenomena in Precipitation from Aqueous Solutions
No. 15 Recommendations on Nomenclature for Chromatography
No. 16 Recommendations for Nomenclature of Thermal Analysis
No. 17 Recommendations for Nomenclature of Mass Spectrometry
No. 18 Recommendations on Nomenclature of Scales of Working in Analysis

Commission V.4: Spectrochemical and Other Optical Procedures for Analysis

The Commission had continued its work on the series of reports under the general heading of 'Nomenclature, Symbols, Units, and their Usage in Spectrochemical Analysis'. Two further parts had been published in tentative form and work was proceeding on X-Ray spectroscopy and on spectrochemical radiation sources.

Reports: Nomenclature, Symbols, Units, and their Usage in Spectrochemical Analysis, Part I: General Atomic Emission Spectroscopy: *Pure Appl. Chem.*, **30**, 651 (1972)

Appendices to the *Information Bulletin*, November 1972—

- No. 26 Nomenclature, Symbols, Units, and their Usage in Spectrochemical Analysis, Part II: Terms and Symbols Related to Analytical Functions and their Figures of Merit
- No. 27 Nomenclature, Symbols, Units, and their Usage in Spectrochemical Analysis, Part III: Analytical Flame Spectroscopy and Associated Procedures

Commission V.5: Electroanalytical Chemistry

The Commission was continuing its work on the purification of organic solvents used in electroanalytical chemistry. A report on *N*-methylpropionamide had been sent to the Division Committee for approval and reports on hexamethylphosphorictriamide and sulfolane were under review by the Commission. Also under review were reports on the purification of supporting electrolytes and halfwave potentials in *N,N*-dimethylformamide and sulfolane. Other projects making good progress included a compilation of pK values in *N,N*-dimethylformamide, studies on the pretreatment of solid electrolytes, conditional diffusion currents, standard potentials in fused salts, and recommended terminology and symbols for the medium effect.

A report on scales of ion activity for the standardization of ion-selective electrodes was with the Division Committee. A report on the status of the Faraday constant as an analytical standard had been referred back to the Commission by the Bureau. Another report, on the classification and nomenclature of electroanalytical techniques, which was submitted for publication as a tentative report, was held up whilst differences between the Commission and the Interdivisional Committee on Nomenclature and Symbols were being resolved, but it had now gone for publication.

Reports: Purification of Dimethylsulfoxide for Electrochemical Experimentation: *Pure Appl. Chem.*, **25**, 457 (1971)

Pyridine: Purification and Tests for Purity: *Pure Appl. Chem.*, **27**, 265 (1971)

Propylene Carbonate: Purification and Tests for Purity: *Pure Appl. Chem.*, **27**, 273 (1971)

N-Methylacetamide: Purification and Tests for Purity: *Pure Appl. Chem.*, **27**, 281 (1971)

Selected Constants: Oxidation–Reduction Potentials of Inorganic Substances in Aqueous Solution: Supplement to *Pure Appl. Chem.*, 1971

Dissociation Constants of Organic Bases in Aqueous Solution—Supplement 1972: Supplement to *Pure Appl. Chem.*, 1972

Appendix to the *Information Bulletin*, August 1973—

No. 30 Classification and Nomenclature of Electroanalytical Techniques

Commission V.6: Equilibrium Data

The work of gathering data for the next supplement to *Stability Constants* was proceeding. Publication was planned for 1976 but the magnitude of the task and the expense involved made it imperative to seek financial support.

A series of reports on distribution equilibria was at various stages of progress—a report on organophosphorus extractants had been approved by the Division Committee whilst those on alkylammonium salts, chelating and miscellaneous extractants were being finalized by the Commission. The project on critical surveys of solution equilibrium constants was progressing in parts: the chapter on organophosphorus extractants was in process of Division approval; chapters on EDTA and cyanide complexes should be finalized by the Commission at the Conference. It was hoped that reports on symbols and terms for mixed ligand constants and on ion-exchange equilibria would be approved by the Commission at the Conference.

A proposal for a major project on solubility data involving collaboration with CODATA and the Gmelin Institute was being studied and would be discussed at the Conference. So also would the work of an *ad hoc* Committee which had been studying the possibilities for key-coding abstracts to aid information retrieval.

Report: Equilibrium Constants of Liquid-liquid Distribution Reactions. Introduction and Part I: Organophosphorus Extractants—Supplement to *Pure Appl. Chem.* (in press)

Commission V.7: Analytical Radiochemistry and Nuclear Materials

A report on high energy photon activation had been approved by the Division Committee; a report on light element analysis by radioanalytical methods would be reviewed by the Commission at the Conference. The Commission had endorsed two materials available from the US National Bureau of Standards (dried orchard leaves and glass wafers doped with impurities) as suitable reference materials for trace analysis by nuclear methods of some elements. A project on the state of the art of nuclear materials analysis, formerly restricted to the analysis of uranium oxides and graphite, was to be discussed with the view of widening its scope. The first part of the glossary of nuclear terms had been published as a tentative report and progress was being made on a second part. A project on the development of conventions for flux monitoring, similar to the Texas Convention for 14-MeV neutrons, had been concentrated initially on updating this Texas Convention and a revised draft was under consideration.

Drafts of reports on methods of analysis of fissile elements and on separation techniques in radioanalytical chemistry were under consideration by the Commission. A first report, on lead, of a series on nuclear methods for the determination of key elements in pollution problems should be finalized at the Conference; a report on cadmium was in progress.

Reports: Radioactive Tracers in Inorganic Chemical Analysis: *Pure Appl. Chem.*, **26**, 257 (1971)

Preparation of Reference Samples for Uranium in Low Grade Ores: *Pure Appl. Chem.*, **27**, 291 (1971)

High Energy Photon Activation: *Pure Appl. Chem.* (in press)

Appendix to the *Information Bulletin*, June 1972—

No. 25 Recommendations on Nomenclature for Nuclear Chemistry

W. KEMULA
President, Analytical Chemistry Division

VI. APPLIED CHEMISTRY DIVISION

Report of President

The Applied Chemistry Division Committee met with the Chairmen of its Sections at Strasbourg in September 1972 to discuss accomplishments and future plans for the Sections, for the Commissions, and for the Division. A summary of that meeting was published in *IUPAC Information Bulletin* No. 45 (May 1973) (pp. 36-42).

The Strasbourg meeting provided an excellent opportunity to exchange information on the programmes and problems of each Section, to observe the interrelation of the Sections, and to deliberate on the synthesis of the Section programmes into a dynamic Division programme. A number of operational questions were raised, which would be discussed further and resolved at the Munich Conference.

Section VI.1: Food

The Section provided an appropriate forum for the expert discussion of international problems in pure and applied chemistry related to food. These problems were diverse and included matters of nomenclature and compositional standards, but they tended at the present time to be largely analytical in character. This was not unexpected in a field of applied chemistry at a time when there was worldwide interest in problems of environmental quality and consumer protection.

During the year major efforts had gone into progressing arrangements for the IUPAC-IUFoST Symposium on Contribution of Chemistry to Food Supplies to be held in Hamburg in August 1973. In addition, consideration was being given to the organization of a symposium on Harmonization of Collaborative Analytical Studies on Food.

The programme of the Food Section at the present time consisted of:

- (a) overall management of the affairs of the Section and its two Commissions (including publications);
- (b) generally advising on relationships between IUPAC and IUFoST;
- (c) progressing, with the Coordinating Committee for Analytical Methods for CEE and IARC and in conjunction with the Analytical Reactions and Reagents Commission of the Analytical Chemistry Division, arrangements for the IUPAC-CEE annual contracts;
- (d) consideration of the problem of antibiotic residues in foods.

A number of reports had been published since the Washington Conference, including those on analytical methods for trace aspects of mycotoxin, polynuclear aromatic hydrocarbon and nitrosamine analysis.

The analytical emphasis of the present programme was likely to continue as a prominent theme in the next five years. In these circumstances it was important that there was adequate liaison with the Analytical Chemistry Division. This the Food Section had established in recent years, particularly in connection with the analytical aspects of the IUPAC-CEE contracts.

Commission VI.1.1: Food Additives

The activities of the Commission involved development of specifications and/or analytical methods required on an international basis to assure the acceptable quality and the safety of food additives and of foods containing food additives. The subject also included drugs or other additives used in

animal husbandry which resulted in significant residues in the meat or other edible products derived from animals subjected to such additives.

The programme at the present time was concerned with:

- (a) trace nitrosamine analysis and matters relating to the formation of precursor amines (a collaborative study was planned);
- (b) trace nitrate and nitrite analysis (survey of available procedures; selection of a procedure for collaborative study);
- (c) multiresidue studies in polynuclear aromatic hydrocarbon trace analysis (a completed collaborative study);
- (d) methods for the estimation of traces of antioxidant residues in food (survey of procedures).

The Commission also planned to consider and recommend analytical studies related to particularly hazardous potential drug residues in edible animal products, to artificial sweeteners, and to problems associated with polymeric packaging of foods.

Commission VI.1.2: Food Contaminants

The activities of the Commission involved studies of analytical methods for trace elements, as well as mycotoxins, with the objective of providing internationally accepted standards for these analyses in foodstuffs. Specifications for single cell proteins (analytical aspects) and for dispersion solvents used in the food industry (chemical aspects) were also within the purview of this Commission.

The Commission arranged a successful International Symposium on Control of Mycotoxins in Sweden in 1972. About 80 persons, representing 18 countries, attended. Thirty papers were read, most of which were being published in *Pure and Applied Chemistry*. A similar, followup symposium was being planned for Poland in 1974. The Chairman, Dr. R. MARCUSE, had also arranged a special half-day 'Round Table' discussion on international aspects of the purity control of food additives for the IUPAC-IUFoST Symposium to be held in Hamburg in 1973.

The programme of the Commission at the present time was concerned with:

- (a) analytical methods for traces of cadmium, copper, lead, fluoride, mercury, and selenium in food (mercury method being tested; other methods being collected);
- (b) methods for trace mycotoxin analysis (study of aflatoxin M in milk published; cooperative study with AOAC to be completed by Munich meeting);
- (c) analytical aspects relating to specification requirements for single cell proteins (reviews on available lysine, methionine, and purine now prepared for evaluation at Munich);
- (d) consideration of the chemical aspects of specifications for dispersion solvents used in the food industry.

Section VI.2: Fermentation Industries

In pursuit of its objectives, the Section programme was designed to provide involvement in international meetings concerned with practical application

of microbial processes as well as development of standards of measurement, of quality, and of nomenclature for fermentation products. The Section served as a focal point for collaboration and cooperation with a number of other international organizations and also provided certain educational services.

In August 1972 the I International Symposium on Advances in Microbial Engineering was held in Mariánské Lázně under IUPAC sponsorship. This Symposium included a panel discussion on single cell protein. At the IV International Fermentation Symposium held in Kyoto in March 1972, the participants unanimously accepted the invitation, extended by the Institut für Gärungsgewerbe und Biotechnologie, to hold the V Symposium in Berlin in 1976.

A symposium designed to serve the industrial sector in rational attack on the problems of water pollution would be planned jointly with the Water Quality Section at Munich.

The programme of work included the following:

- (a) In cooperation with the Food Section and the Protein Advisory Group of the United Nations, the Section had been concerned with standards for microbial protein (single cell protein) produced for animal feed purposes from petroleum substrates. The need was for product standards which could be applied to assure identity, quality, acceptability, safety, and nutritional value.
- (b) There was little understanding or agreement concerning the training and skills required for bioengineering (the application of engineering to biological processes). Thus, the Section aimed to improve international understanding of bioengineering education through definition of terms, skills, and curricula.
- (c) The Section had developed standards for inactive dry yeast which, in general, defined the nutritional value of the product and provided an international basis for product evaluation. Work was in progress in cooperation with ICC on the even more important problem to assess the value and effectiveness of active dry yeast as a leavening agent.
- (d) Ultimately, organic pollution in water must be discharged by microbial activity. Techniques comparable or identical to those employed in the fermentation industries would be essential to pollution control. Thus, the Section, which brought together microbiological and chemical skills, was particularly adapted to the solution of problems in water pollution and discussions would be held jointly with the Water Quality Section to exploit this expertise.

Section VI.3: Oils and Fats

The Section had as its task the selection, testing, wording, publication, and revision of standardized methods for analysis of oils and fats, indispensable to the manufacture and the use of fat products. The normal and usual chemical methods of fat analysis having been mostly standardized now, the Section had to cope more and more with physical, biological, and newer instrumental methods of analysis. Section Members provided liaison with many national and international committees engaged in the examination of fats and allied products which relied on the Section's recommended methods.

In September 1972 a meeting of the Section was held in Chester to discuss in detail a number of proposed standard methods.

Work programmes were presently as follows:

(a) COLLABORATIVE ANALYSES

- (1) determination of the melting behaviour;
- (2) determination of the total oxidized fatty acids;
- (3) determination of fatty acids at β -position in triglycerides by pancreas lipase;
- (4) detection and identification of antioxidants in oils and fats;
- (5) determination of lower fatty acids by gas-liquid chromatography;

(b) METHODS TO BE EXAMINED

- (1) determination of tocopherols in oils and fats;
- (2) keeping and preserving oils and fats;

(c) METHODS TO BE CONSIDERED

- (1) testing of technical fats;
- (2) oxygen absorption of oils and fats in comparison with the AOCS method (Active Oxygen method) and the proposed ISO procedure;
- (3) margarine analysis;
- (4) determination of traces of sulfur, mercury, lead, cadmium, copper, nickel, *etc.*, in fats and oils;
- (5) colour stability of technical fats against storage and heat;
- (6) analysis of fatty amides, nitriles, amines, and quaternaries.

(d) PUBLICATION OF STANDARDIZED METHODS [Second Supplement (1973) to *Standard Methods for the Analysis of Oils, Fats, and Soaps*]

II.D. 7 Iodine Value

II.D.17 Determination of Di- and Tri-unsaturated Fatty Acids by UV Spectrophotometry

II.D.20 Determination of Epoxy-group Oxygen

III.A. 2 Determination of Arsenic in Glycerol

IV.A.11 Determination of the Unsaponified and Unsaponifiable Matter in Soaps

IV.A.12 Determination of Small Quantities of Glycerol in Soap

Section VI.4: Air Quality

Work programmes were as follows:-

(a) A number of methods involving air and/or biological materials had been prepared in preliminary form:

- benzo(a)pyrene in air
- lead in air (atomic absorption)
- lead in air (colorimetric)
- vanadium in air (atomic absorption)
- vanadium in air (colorimetric)
- hydrogen chloride in air
- cadmium in air (atomic absorption)
- specifications for indicator tubes

(b) In what might be called the final editorial process, were methods for:

- fluoride in air (colorimetric)
- cadmium in air (dithizone)
- iron fume in air (bathophenanthroline)
- antimony in air (Rhodamine B)

- hydrazine in air (colorimetric)
- ozone in air

Section VI.5: Pesticides

This Section concerned itself generally with matters of policy, international liaison, membership, sponsorship and arrangement of symposia and conferences on pesticide chemistry, *etc.* The detailed work was carried out through its two Commissions and was largely based on problem areas as indicated by the requirements of the annual FAO-WHO Joint Meeting on Pesticide Residues. There was also close association with other international bodies such as the FAO-WHO Codex Alimentarius Commission, OECD, CEE, and the joint FAO-IAEA Programme on Pesticide Residues and Pollution.

Plans were proceeding for the III International Congress of Pesticide Chemistry, sponsored by IUPAC and due to be held in Helsinki in July 1974.

Commission VI.5.1: Terminal Pesticide Residues

The Commission was concerned with the nature of the terminal residues of pesticides and with the metabolic pathways by which degradation occurred. It evaluated available information, stimulated work in progress, and attempted to initiate work in neglected areas of importance. In particular, it had carried out a great deal of useful work with respect to cyclodienes, BHC, fumigants, dithiocarbamates, carbamates, rethrans and synergists, and organophosphorus pesticides.

Arising directly from the 1971 and 1972 FAO-WHO Joint Meetings, requirements for information relating to the nature of the terminal residues of a number of fumigants and other pesticides had been circulated to the Members of the Commission and reports would be prepared for discussion at this year's meetings. For other compounds, ongoing arrangements had already been made to report progress.

Commission VI.5.2: Pesticide Residue Analysis

The Commission was concerned with the suitability of various analytical procedures for the residues identified as important by the Terminal Residues Commission. The Residue Analysis Commission had been particularly concerned with multiresidue procedures for organochlorine, organophosphorus, and fumigant compounds. The requirements of the FAO-WHO Joint Meeting were carefully considered and advice on availability of procedures suitable for regulatory purposes was given to the Joint Meeting and also to Codex.

Members had taken part in various international (and national) collaborative studies on analytical methods, but none had been organized by the Commission; attempts to set up a study of fumigant methods were unsuccessful, mainly because so few laboratories were both equipped for and interested in such a study.

There were no major new requirements for analytical methods arising from the FAO-WHO Joint Meetings, but reports on progress in the fields of continuing interest over the years 1971-73 were being prepared for the Munich Conference.

The previous recommendations of the Commission relating to multiresidue methods had been of great use in relevant international discussions and would be updated as necessary. It was hoped that they would then be published together in suitable format.

Section VI.6: Organic Coatings

At the meeting of the IUPAC Council in Washington, DC (1971), it was resolved that the Section on Organic Coatings should continue its activities until the end of the next Conference (Munich, 1973) and then to terminate as part of the Applied Chemistry Division. Meanwhile, efforts were being made to explore the incorporation of appropriate activities of the Section elsewhere within the IUPAC structure, e.g., Macromolecular Division. Also, the possibility of continuing the Section outside of the Union was under consideration.

'Recommended Methods for the Analysis of Alkyd Resins' had been published in *Pure and Applied Chemistry* [33, 411 (1973)]. The texts for the analysis of acrylic and polyurethane resins were in their final phase and would soon be ready for publication. Work on the analysis of polyamide resins had started. Further material for the information retrieval project had been collected and a report was in preparation.

Section VI.7: Water Quality

The prime objective of the Section was to study the development of technology and to demonstrate possible applications of the two principal possibilities to solve waste water problems: (a) to reduce or eliminate the pollutants where they emanated, by means of changes in the industrial process, recycling, and similar measures; (b) to treat the waste water with respect to polluting and harmful substances.

Another objective was to encourage the use of correct, appropriate, and internationally recognized methods for characterization of water and waste water. A third objective of the Section was to keep itself informed about the general development of matters relevant to water quality.

Four Titular Members of the Section held a meeting at Zürich in January 1973 to complete the programme of the symposium for which the Section was responsible in connection with the XXIV IUPAC Congress in Hamburg in 1973, entitled 'Modern Methods for the Treatment of Waste Water in Theory and Practice'.

The Section was also working on a study covering 'Water and Waste Water Recovery, Reclamation, and Recycle in Different Types of Industry', for possible presentation at a symposium in Stockholm in 1975.

In cooperation with the Section on Fermentation Industries, the Section on Water Quality was planning to promote a conference on microbiological aspects of waste water treatment.

Following the suggestion of the Organizing Committee of the XXV IUPAC Congress in Jerusalem (1975), the Section would take responsibility for a programme on reutilization of industrial refuse as raw material.

The Section had followed the work within ISO Technical Committee 147 (Water Quality), but had so far found no cause for comment on the results hitherto achieved. Dr. P. O. BETHGE, as IUPAC representative, had attended the first meeting of the Committee in Geneva in April 1972. Through Prof. E. A. PEARSON, the Section was participating in the work within the COWAR Committee of ICSU.

The Section had also followed the development of matters relevant to water quality in some of the more important types of industry through its Members and through the results of activities within international organizations such as OECD, ECE, FAO, WHO, and IAWPR.

The activity of the Section had been and was at present concentrated on the

means and technology to reduce or stop the emission of polluting substances from industries to water. This technology was naturally of importance to the chemical industry, both in its capacity as polluter and as producer of chemicals for waste water treatment processes. Still more important was that this kind of technology had to a great extent become a working field for chemists and chemical engineers.

R. W. CAIRNS
President, Applied Chemistry Division

CLINICAL CHEMISTRY SECTION

Report of Chairman

The Section on Clinical Chemistry had been in full operation, as far as possible, during the past two years. The usual difficulties, due to the lack of funds to cover more than one meeting a year and the great distances between the cities in which the various Members lived, had been encountered. Outstanding events were the meetings of the Commissions and of the Section in Copenhagen in June 1972 at the time of the VIII International Congress of Clinical Chemistry. This Congress provided an opportunity for a number of the National Representatives to meet with the Members of the Section and to attend its various meetings.

The Chairman of the Section attended the Bureau meeting held near Strasbourg in September 1972 and found this to be a very valuable experience. An important decision for the Section was made by the Bureau when approval was given to the report of an *ad hoc* Committee recommending the establishment of a Commission on Clinical Toxicology.

The Chairman had also been involved in discussions with the Organizing Committee for the IX International Congress of Clinical Chemistry to be held in Toronto in July 1975. The Section wished to have IUPAC sponsor the Congress, and was willing to act as the sponsoring group in this eventuality. The major sponsor for the Congress was IFCC, an Associated Organization of IUPAC. During the past two years the close ties between IFCC and the Section on Clinical Chemistry had been maintained.

An invitation was received by the Chairman early in 1973 to have the Section organize a clinical chemistry programme for the XXV IUPAC Congress to be held in Jerusalem in 1975. Unfortunately, it was deemed impossible to accept this invitation because many of the Section Members would be involved in two other meetings in 1975, namely, the XXVIII IUPAC Conference and the Toronto Congress. The Organizing Committee for the Jerusalem Congress had finally decided to eliminate clinical chemistry from its programme.

The IUPAC-IUB Commission on Biochemical Nomenclature (CBN) invited the Section to send an Observer to its meeting in Meersburg in June of this year. The invitation was accepted and Dr. R. DYBKAEER (Chairman, Commission on Quantities and Units) agreed to attend.

Several Members of the Section, none however directly representing the Section, attended the International Conference on Standardization of Diagnostic Materials held in Atlanta, Georgia, during June 1973. This Conference was sponsored jointly by WHO and the US Center for Disease Control. One of the impressions gained by Dr. M. ROTH, Secretary of the Section, was that WHO wished to have the help of other international bodies such as IUPAC in dealing with the problems of standardization of laboratory procedures, reagents, and instruments. IFCC was also vitally concerned with these problems, and it was the feeling of several Members that the Section should also become actively involved with them and with WHO.

Commission on Automation

Draft reports entitled 'Glossary of Terms used in Automatic Analysis' and 'Recommendations concerning Automated Analysis in Clinical Chemistry' had been produced and would be discussed with the Commission on Analytical Nomenclature at the Munich Conference. Two related subjects were

being considered by the Commission: (a) Evaluation of Automatic Laboratory Equipment, and (b) Concepts of EDP in Clinical Chemistry, and these would be discussed further at the Conference.

The Chairman, Prof. T. P. WHITEHEAD, played an active role in several sessions at the Copenhagen Congress of Clinical Chemistry and was Chairman of a symposium on 'The Use of EDP in Clinical Chemistry'. Dr. D. S. YOUNG, a Member of the Commission, also participated in this symposium, speaking on 'Data Acquisition and Computers'.

Commission on Quantities and Units

At the Commission meeting in Washington in July 1971 two manuscripts were thoroughly reviewed and in accordance with the decisions made, these manuscripts were finalized and appeared in February of 1972 as Tentative Nomenclature Appendices No. 20 entitled 'Quantities and Units in Clinical Chemistry' and No. 21 on 'List of Quantities in Clinical Chemistry'. Both were published jointly by IUPAC and IFCC (because the Expert Panel of the latter body had participated in their production) and comments were elicited from around the world.

A number of letters were received from national organizations and individuals. A draft was being prepared for the final recommendations, based on the tentative versions, recent evolution in nomenclature, and on the comments received. Special consideration was being given to the problems of enzyme nomenclature because CBN, after extensive correspondence with Dr. DYBKAER, had chosen other definitions from those originally agreed upon. The draft for the final recommendations would be reviewed at the forthcoming Munich meeting of the Commission.

Each Member of the Commission had endeavoured to spread the tentative nomenclature recommendations in his respective region and to assess the *present state of affairs*. Argentina, Denmark, Finland, and Netherlands had converted to their use. UK had started a stepwise conversion. Sweden expected to change in 1974 and strong movements were occurring in France, Germany, and Switzerland. Members of the Commission had given lectures and published several papers on the recommendations.

Manuscripts were being prepared for new descriptions of kinds of quantity in the field of spectroscopy, chemical activity, and allied physicochemical kinds of quantity. The drafts would be discussed at Munich.

Commission on Teaching

The text of the *Manual on Teaching in Clinical Chemistry* was being edited. A review of the draft status of the monograph was carried out at the Copenhagen meeting in June 1972. This included a review of the status of the national reports on the teaching of clinical chemistry, prepared by selected clinical chemists in the various countries in cooperation with IFCC.

Some changes in content of the monograph were proposed. For example, it was decided that more consideration should be given to the history of clinical chemistry teaching in non-Anglephone countries. The need to extend the historic development of specialist journals in clinical chemistry was considered, as well as the addition of a section on the application of clinical chemistry to preventive health.

The Commission reviewed the reports of the subcommittees dealing with 'the physicians viewpoint as to the required education in medical subjects required by the non-physician chemist' and 'the required education in chemical and physical science for physicians in clinical chemistry'.

Considerable time was spent on the problem of the format uniformity of the many national reports (most of them recently updated) now in hand. Because of the problem of communication the Commission Members decided to undertake the redrafting of these reports themselves when rapid responses from the respective countries were not forthcoming. A major problem was that of a deadline for material to be included in the monograph, because the subject of clinical chemistry was in a state of great flux due to constant changes in legislation and in teaching programmes in many countries. It was planned to review the entire monograph at the Munich Conference.

D. B. TONKS
Chairman, Clinical Chemistry Section

COMMITTEE ON TEACHING OF CHEMISTRY

Report to Council

Loss of Sir Ronald Nyholm

The Committee on Teaching of Chemistry and the entire scientific world suffered a major loss in December 1971, when Sir RONALD NYHOLM, first Chairman of this Committee and an active contributor to worldwide chemical education at all levels, was killed in an automobile accident. He is sorely missed. With the death of Prof. NYHOLM the scientific world lost one of its truly great leaders.

Organizational Matters

In February 1973 the Executive Committee of the Union gave final approval to Standing Orders which fixed the terms of office of Members of the Teaching Committee. According to these Orders, the terms of several Members who had been active since the Committee was first founded, have now expired. We thank them for their excellent service. Names of potential new Members are being furnished to the Executive Committee.

As noted in our report of 1971 a system of National Representatives to the Committee was created to facilitate communication on matters pertaining to chemical education. Forty-one countries have now designated such National Representatives, leaving only three National Adhering Organizations to take action.

Activities

A. *International Meetings*

Washington Meeting of National Representatives. On 22 and 23 July 1971 a meeting of Committee Members and National Representatives was held in Washington, DC, to review past activities in the field of chemical education and to consider new programmes. Several of the items considered later in this report were initiated at that meeting.

São Paulo Meeting. In September 1971 the IUPAC Committee on Teaching of Chemistry joined with the Brazilian Academy of Science and the University of São Paulo in sponsoring an international symposium emphasizing chemical education in South and Central America. Prof. E. GIESBRECHT was General Chairman. Our Brazilian hosts did an excellent job and the meeting was very successful.

Forthcoming Wrocław Conference. UNESCO and the IUPAC Committee on Teaching of Chemistry are jointly initiating a series of worldwide conferences on chemical education. Such conferences will be held once every 4 years and will provide a review of existing practice as well as an opportunity for worldwide communication between chemical educators. The report of each conference will be published as a joint UNESCO-IUPAC publication. The first of such conferences is to be held in Wrocław, Poland, during the period 17-22 September of this year. The Polish Academy of Science is the host and cosponsor of this year's meeting. It is hoped that all National Representatives and many other interested participants will attend. Any interested Council Members are cordially invited to attend.

B. Publications

1. Three papers given at the Washington Conference in 1971 were published in *Information Bulletin* No. 41 (November 1971). These treated the general topic of Chemistry for the Concerned Citizen:

WILLIAM B. COOK, 'Chemistry: An approach to Understanding Science in Society'

D. G. CHISMAN and R. S. NYHOLM, 'Chemistry for the Concerned Citizen in UK and British Commonwealth'

C. N. R. RAO, 'Chemistry for the Concerned Citizen—The Case of India'

These papers subsequently appeared also in the *Journal of Chemical Education*.

2. *Survey of Chemistry Teaching at the University Level* (edited by A. K. HOLLIDAY and R. MASKILL) was published by IUPAC in 1972 on behalf of UNESCO.

C. Other Activities

Nomenclature. A subcommittee of the Teaching Committee, involving Prof. J. A. CAMPBELL (USA) and Mr. D. G. CHISMAN (UK), is working with Nomenclature Committees of IUPAC and with various national nomenclature groups: (a) to formulate an abbreviated and simplified nomenclature presentation for use in schools, (b) to initiate action with authors and teachers to promote the adoption of proper nomenclature practices, and (c) to foster the use of IUPAC approved units. Progress is slow, but we believe real.

Survey of Books in the Field of Chemistry. Pursuing a suggestion arising from the Washington Conference, Dr. P. SYKES, acting as a subcommittee of the Teaching Committee, collected information on chemistry books, their sources, and use in the educational process. An informal summary of the 'text book questionnaire' had been compiled and distributed to the National Representatives. The abbreviated summary is available from the IUPAC Secretariat on request. A Book Exhibit was held in conjunction with the 1971 IUPAC Conference in Washington, DC.

Chemical Education Newsletter. Prof. C. N. R. RAO, acting as a subcommittee of the Teaching Committee, is currently accumulating information for a Chemical Education Newsletter which will be distributed internationally on a trial basis.

Cooperation with Other IUPAC Bodies. The Teaching Committee is more than willing to cooperate with other IUPAC bodies concerned with the teaching process. A joint meeting with representatives of the Commission on Teaching of Clinical Chemistry was held in Washington in 1971. Continued cooperation is anticipated.

R. W. PARRY
Chairman, Committee on Teaching of Chemistry

COMMITTEE ON PUBLICATIONS

Report to Council

It is my intention to retire from the Chairmanship of the Publications Committee at the IUPAC Conference in Munich, although I hope to maintain a close interest in its work. It might be appropriate, therefore, to review briefly the evolution of IUPAC's publications policy and progress over the past 16 years.

Some will remember that before 1957, the publication and dissemination of IUPAC's work was not very satisfactory. In that year, it was decided to appoint a commercial publisher, Butterworths Scientific Publications, to deal with the important items such as nomenclature reports. The success of this experiment led the Union in 1959 to start a journal of its own, *Pure and Applied Chemistry*, which was to include nomenclature and Commission reports, and similar items, together with the main lectures given at symposia sponsored by the Union. The first volume of this journal appeared in 1960. At first there were two volumes annually, in 1969 three, and since 1970 four. By mid-1973, 34 complete volumes will have been issued. A few supplementary (now to be called 'additional') volumes had been published, to cater for large specialized reports and other articles which for one reason or another might be less appropriate to the journal.

A journal of this sort had a special character, of course, because it contained material of quite diverse kinds. It was expected that while some scientists and libraries might wish to subscribe to the whole journal, others would prefer to obtain only the sections of special interest to them as separate bound offprints, whether Commission reports or lectures at symposia. This procedure had proved successful. At present there were more than a thousand regular subscribers, and, in addition, of the bound offprints several had sold more than 3,000 copies, a number more than 2,000, and very many between 1,000 and 2,000.

Under the contract made, the Publisher took the financial risk and royalties were paid to the Union at agreed rates. The copyright of the Union and the agreement with the Publisher had to be respected, but arrangements had been made to permit some flexibility in the general interests of science. Complete freedom to reprint was allowed for special items such as the revised atomic weight tables, subject to acknowledgement of IUPAC; translation of nomenclature reports into other languages had been allowed if properly authorized by the Union through the National Committee concerned; arrangements had been made with the Publisher for publication of work carried out jointly with other Unions, such as IUB, and although a general policy had been followed of avoiding republication of a given lecture elsewhere, even this had been allowed in certain cases at a small fee. Frequently, too, the Union's right to publish sponsored symposia had been waived, but in this matter the Union might in future do well to protect its legitimate interests. Some problems arose due to the irregularity with which Commission reports were received, and also because symposia were not spread uniformly throughout the year, but a steady schedule of publication had been developed, mainly through careful planning by the Secretariat. In all these matters, those concerned with the editorial and publishing aspects had received much help from Division Presidents and Organizers of symposia, for whom guidelines had been laid down and were circulated regularly. The Publisher, also, had taken a sympathetic and generous attitude towards the Union's problems

throughout. At the Boston Congress (1971), the main lectures at the symposia were printed by photooffset, which enabled speedy publication after the meeting. The experiment would be continued at the Hamburg Congress (September 1973).

The *Information Bulletin*, started by Dr. R. MORF about 1956, had recently undergone some interesting changes. In view of the increase in general information about the Union's work, it became desirable to obtain a more regular publication schedule, and the compilation, production, and distribution of the Bulletin were transferred to the Secretariat. This had led to a decrease in the costs of publication, and also recently to a rapid increase in the number of requests to purchase copies. Four years ago, it was decided to split off two types of report from the Bulletin itself, which was printed on green paper, and to print them in the same style and format, but as Appendices: namely, the Tentative ('provisional') Nomenclature Recommendations on yellow paper, and other Technical Reports which were less appropriate to the journal on blue paper. There were signs already that the new-style Bulletin and Appendices had gained widespread interest, and the Union was getting a modest income from their sales.

Last year, the Union received about \$24,000 as royalties on the journal and its ancillary publications, and about \$5,000 from sales of publications by the Secretariat. Since 1960, covering 13 years, the total sum received from Butterworths as royalties had exceeded \$160,000. At the request of the Treasurer, a detailed analysis of the finances of all IUPAC publications was made recently. There was expenditure on salaries and editing, the cost of printing the Comptes Rendus, Information Bulletin and its Appendices. Income was derived from royalties and sale of the Bulletin and Comptes Rendus. An agreed number of free copies of the journal was supplied by the Publisher. The analysis showed that for 1972, after covering all expenditure, there was a surplus of about \$6,000 to transfer to the general funds of the Union. The price of the journal had not been raised for 2 years, but it seemed inevitable that some increase would have to be made for 1974.

It was fortunate that the Union was in a position to supply copies of its publications to those who originally joined IUPAC as Company Associates. However, as the number of these publications increased rapidly in recent years, it became clear that the Union was having to spend a disproportionately large fraction of the subscription received upon the purchase of these publications. Recently, some changes had been made which should reduce this difficulty. An article, and a brochure, had also been prepared recently, describing the aims and mechanism of IUPAC and these had been distributed widely. It was hoped that they would encourage many other industrial firms to join in the Union's affairs, and bring its work to the attention of many younger scientists.

The Publications Committee had met annually, and examined continuously both current practical problems and future policy. Minor changes which seemed desirable were being made progressively. The Committee had considered bigger issues, such as the future style and mechanism of IUPAC publications, and should certainly continue to keep this matter in mind. Terms of Reference and Standing Orders for the Committee had been approved recently. Two additional Members had been added to the Committee, and a system for retirement and replacement had been laid down. It would be wise to retain as Members of the Committee both specialists in editorial work and others who had a more general knowledge of the Union's business. It does not seem to me that the Union can afford to make startling and risky

experiments, the success of which is still not proven in science as a whole.

I must again emphasize the debt owed by the Union to the Scientific Editor, Prof. B. C. L. WEEDON; his assistant, Prof. C. F. CULLIS; to the staff of our Secretariat; and to our Publisher for the success of our venture into the field of scientific publishing.

H. W. THOMPSON
Chairman, Committee on Publications

MINUTES OF XXVII COUNCIL MEETING

29 and 31 August 1973

Present: Prof. J. BÉNARD (President, in the Chair), Members of Bureau, Delegates of National Adhering Organizations, Delegates of Associated Organizations.

All statutory actions necessary for convening a meeting of Council had been taken through the following letters:

re. Official invitation to National Adhering Organizations, 72.11.30 (1411/RR/CAD/72)

re. Official invitation to Associated Organizations, 72.11.30 (1412/RR/CAD/72)

re. Members of IUPAC Bodies, 72.11.30 (1381-1384, 1401, 1409/RR/CAD/72)

re. Nomination of Candidates for Elections (Officers and Bureau), 73.1.19 (WG) and 73.4.30 (622/MW/MG/73)

re. Announcement of Candidates for Elections (Officers and Bureau), 73.7.6 (836/MW/MG/73)

re. Draft Council Agenda, 73.1.19 (WG)

re. Final Council Agenda, 73.4.30 (622/MW/MG/73)

re. Documentation available for Council Agenda Items, 73.5.11 (386/MW/MG/73), 73.6.20 (738/MW/MG/73), 73.7.6 (836/MW/MG/73), and 73.7.31 (1047/MW/MG/73)

Minute 1 Introduction

In his opening remarks, Prof. BÉNARD paid tribute to the colleagues deceased since the last Conference: H. A. BOEKENOOGEN, I. BOSUND, L. DEFFET, C. N. FREY, P. KARRER, A. KATCHALSKY, M. LETORT, H. LUNDIN, R. S. NYHOLM, R. PIONTELLI, J. E. PRUE, A. RINGBOM, W. ROMAN, H. W. TALEN, J. TIMMERMANS, A. TISELIUS, A. R. TOURKY, H. F. WACHSMUTH.

Minute 2 Finalization of Agenda

Prof. BÉNARD proposed that Items 10 and 11 (see page 9) be considered immediately after Item 7, so that all major financial matters were grouped together. The Agenda for future Council meetings should be prepared accordingly. No discussion of Item 15 was now necessary, because the promised support of the Austrian Government in respect of office accommodation for the International Office for Analytical Chemistry had been postponed indefinitely and the project was to be considered as abandoned.

Minute 3 Approval of Minutes of XXVI Council Meeting

The minutes of the previous Council meeting, as circulated to the National Adhering Organizations and as printed on pages 55-69 of *Comptes Rendus XXVI Conference*, were approved by the National Delegations.

Minute 4 Announcement of Nominations for Officers and Bureau Members

The files for the meeting contained the nominations received by

the statutory deadline, together with biographical notes on each candidate, for vacancies amongst the Officers and Elected Members of the Bureau.

On the recommendation of the Bureau, it was *Resolved* that:

- (i) there be 12 Elected Members of the Bureau for the period 1973-5 (Statute 7.2);
- (ii) the procedure for election of Elected Members of the Bureau be that adopted at Cortina d'Ampezzo in 1969 and Washington in 1971;
- (iii) Sir DAVID MARTIN (UK) and Dr. M. A. PAUL (USA) be elected as Tellers for the duration of the meeting.

In accordance with Bylaw 2.222, the Bureau had discussed the nominations made by the National Adhering Organizations. It had waived its right to make additional nominations, and Council noted the recommendations for filling the 8 vacancies for Elected Members of the Bureau (Minute 4.1, XXXI/B).

Minute 5 Announcement of Time of Elections

The President announced that the elections would be held at 10.00 on 31 August.

Minute 6 Statutory Report of President on State of Union

Prof. BÉNARD referred to his printed report which had been pre-circulated, emphasizing

- the traditional activity of IUPAC in the field of nomenclature, and the appointment of an *ad hoc* Committee to study ways and means of improving the present situation
- the place applied chemistry occupied in the Union, the existence of the Company Associates Scheme, and the Open Meeting on IUPAC activities in Munich
- the development and rationalization of the Union's external relationships during the last two years
- the initiation of a complete revision of the 1965 Statutes and Bylaws in terms of the present situation of IUPAC, with a view to presenting a coherent set of documents to Council in 1975

The report was received with acclamation.

Minute 7 Biennial Report of Treasurer

The report of the Treasurer and the audited accounts for 1971-2 had been circulated before the meeting in printed form. In 1971 there was an excess of expenditure over income of \$50,311.68, but in 1972 an excess of income over expenditure of \$77,041.90 had been achieved. Prof. HORN drew Council's attention to the following needs

- to gain Company Associates through personal contacts, particularly in Canada, Netherlands, and Sweden
- for each country to move into a membership category at least equivalent to its chemical turnover
- for those countries with subscriptions outstanding for 1972 and 1973 to make payment as soon as possible

Prof. BÉNARD paid tribute to the skill and untiring activity of

Prof. HORN in the financial matters of the Union. Council *Resolved*:

that the Treasurer's biennial report and the audited accounts for 1971-2 be adopted.

On the recommendation of Prof. HORN, Council also *Resolved*:
that Neutra Treuhand AG be reappointed as auditor for IUPAC for the biennium 1973-4.

Minute 8 Report of Finance Committee

The Chairman, Dr. BARRETT, said that whilst appreciating it was advisory in nature and should not attempt to generate policy, the Finance Committee firmly believed that it could not effectively discharge its responsibilities for investments and for advice on short- and long-term financial matters without a full understanding of IUPAC policy and changes therein. Dr. BARRETT went briefly through the printed report in the Council file. He stressed that, in view of the deficits budgeted for the next three years, it was essential to raise the national subscription rates to become effective no later than 1975.

The report was adopted by Council without discussion.

Minute 9 Tentative Budgets for 1974 and 1975

Prof. HORN said that the budget estimates presented to Council had been carefully studied by the Finance Committee, Executive Committee, and Bureau. There was a full exchange of views on the estimates in which the Delegations from Belgium, Brazil, Hungary, Israel, Netherlands, and Switzerland participated. The following points were brought out

- 'Travel, Subsistence, Administration of IUPAC Bodies' was presently much higher for 1974 than in 1972 because no limitations of expenditure by the Divisions had yet been imposed by the Treasurer
- although 'Office Expenses' represented a large proportion of the total income, a great deal of this expenditure was in respect of work carried out for the Divisions
- the estimate of \$125,000 for travel and subsistence in respect of the 1975 IUPAC Conference was probably unrealistic
- the further budgetary details made available to the Finance Committee, Executive Committee, and Bureau, could also be provided to Council if required
- the estimated royalties from Butterworths for 1974 might be conservative in view of the 1973 figures; the estimate for 1975 was simply a projection from 1974
- the expenditure envisaged in 1974 on publications issued through the Secretariat was higher than 1973 because of publication of *Comptes Rendus XXVII Conference* and because of transfer of salaries for the Assistant Secretary (Publications) and his secretary from 'Office Expenses'

On the recommendation of the Bureau, Council *Resolved* (100 in favour; 0 against; 18 abstentions):

that the tentative budgets for 1974 and 1975, as amended

by the Executive Committee and supported by the Bureau (see Appendices A and B, XXXI/B) be approved.

Minute 10 Dues Structure and Fixing Annual Dues for 1974 and 1975

At the request of the Swiss Delegation, Council *Resolved* with acclamation:

that on 1 January 1974 Switzerland be transferred from Category B2 to Category A1 membership of the Union.

Dr. BARRETT presented proposals for amending the scheme of national subscriptions approved by Council at Washington in 1971. Attention was drawn to the following points

- a minimum increase of \$35,000 in annual income was needed not later than 1975, and preferably in 1974, otherwise the activities of the Union would inevitably have to be reduced
- the original proposal of the Executive Committee to raise the basic subscription unit from \$400 to \$450 was now judged to be too small an increase
- there had been no real increase in national subscriptions since 1961
- a need was anticipated to move progressively away from the current practice of counting Company Associate income towards national subscriptions
- each National Adhering Organization still remained free to decide which membership category it would occupy, but it was hoped that every country would enter a category at least equivalent to its chemical turnover

The Delegations from Hungary, India, and Switzerland asked questions about the proposals, and it was established that

- the multipliers of the basic subscription unit remained unchanged for Categories B1, B2, A1, and A2
- increasing the basic unit only to \$500 would bring in less than the \$35,000 needed to maintain the Union's activities
- some rounding off of figures had already been done, and a change from the \$1,450 envisaged for Category B1 to \$1,500 might be acceptable

Council *Resolved* (94 in favour; 0 against; 32 abstentions) that starting in 1974:

- (i) the basic unit of annual subscription for National Adhering Organizations be increased from \$400 to \$550, with minimum subscriptions set specially at \$800 for Category C and \$50,000 for Category A3;
- (ii) the minimum subscription for Category D be increased from \$100 to \$200.

Minute 11 Application for National Adhering Organization Status

An application from Akademie der Wissenschaften der DDR to become the National Adhering Organization of IUPAC for the German Democratic Republic already had the support of the Executive Committee and Bureau. After drawing attention to

the good tradition of chemistry in the German Democratic Republic, the Czechoslovak Delegation proposed and Council *Resolved*, on a vote (124 in favour; 0 against; 12 abstentions):

that Akademie der Wissenschaften der DDR be admitted to Category B1 membership of IUPAC.

Council approved the suggestion of Prof. BÉNARD that the representatives of the German Democratic Republic, Prof. H. J. BITTRICH and Dr. W. FRIEDRICH, be invited to sit in as Observers for the rest of the Council meeting. They duly entered the room to a show of acclamation.

Minute 12 Applications for Associated Organization Status

It was *Resolved* on a vote (136 in favour; 0 against; 0 abstentions) that:

- (i) the following independent bodies continue as Associated Organizations of IUPAC for the next biennium:
Comité International des Dérivés Tensio-Actifs
European Federation of Chemical Engineering
European Photochemistry Association
Federation of European Chemical Societies
International Congress on Catalysis
International Federation of Clinical Chemistry
International Magnetic Resonance Society
International Society of Electrochemistry
- (ii) on the recommendation of the Bureau, applications for Associated Organization status be approved from:
Association of Official Analytical Chemists
International Association for Advancement of High Pressure Science and Technology
International Association of Geochemistry and Cosmochemistry
International Committee for Rheology
International Conferences on Coordination Chemistry
International Society of Heterocyclic Chemistry

The Israeli Delegation expressed the hope that some of the Associated Organizations would eventually integrate completely with the Union.

Minute 13 Reports of Division Presidents and Clinical Chemistry Section

The Division Presidents and the Chairman of the Clinical Chemistry Section referred briefly to their precirculated reports of activity since the XXVI Conference (see pages 27-54), then informed Council of the further progress made during the XXVII Conference.

Dr. WADDINGTON emphasized certain new activities within the Physical Chemistry Division. The Sub-Commissions on Plasma Chemistry and on Mass Spectroscopy provided an IUPAC base for the interests of a large number of chemists from throughout the world. The work of the Sub-Commission on Calibration and Test Materials recognized especially the needs of industry.

Prof. GLEMSER reported the proposals of the Commission on

Nomenclature of Inorganic Chemistry in respect of names for elements 104 and 105 and for a systematic nomenclature for elements after 105 prior to their discovery. Prof. BÉNARD informed Council of the further suggestion made to the Bureau for an exchange of representatives of the Berkeley and Dubna laboratories (see Minute 13, XXXI/B). After Prof. GLEMSER had mentioned the future programmes of the Commission on High Temperatures and Refractory Materials, the Hungarian Delegation suggested that the Commission on Colloid and Surface Chemistry should also be involved in the work on nomenclature and characterization of materials containing essentially only carbon.

Prof. OURISSON reported that the Commission on Nomenclature of Organic Chemistry would be moving away from the practice of establishing polished specific rules towards more general recommendations to help editors. Following an appeal from the Organic Chemistry Division Committee and on behalf of its country, the Israeli Delegation offered to act as host for the II IUPAC Conference on Synthetic Organic Chemistry in 1976.

Prof. BENOÎT reported that the Macromolecular Division Committee in Munich had established some guidelines for subjects at future annual International Symposia on Macromolecules. In addition to the active programmes on molecular characterization and performance characteristics, a third Working Party had now been formed to deal with thermodynamic data of polymers. These three Working Parties were to be placed under the control of a proposed new Commission [see Minute 18(vi), XXVII/C]. The Working Party on Supported Polymer Films [see Minute 18(iii), XXVII/C] would initially be attached directly to the Macromolecular Division Committee.

Prof. KEMULA reported that discussions had been held in Munich with a representative of the ISO Central Secretariat on mechanisms for reviewing draft and final ISO Recommendations within the Analytical Chemistry Division. The Division was also interested in participating in the SCOPE work of ICSU and proposed to submit a summary of Divisional activities for the information of SCOPE.

Dr. CAIRNS reported further progress in concentrating the work of the Applied Chemistry Division on problems relating to human welfare, particularly food and the environment, which was begun at Washington in 1971. He recommended that all Sections should be reclassified as Commissions. In addition, he expressed doubts as to whether Council was sufficiently critical in its biennial review of the existence of IUPAC bodies.

After reporting on the increasing level of activity of the Clinical Chemistry Section and its three Commissions, Dr. TONKS expressed the hope that it would not be long before the Section was granted Divisional status within the Union.

Council Resolved:

- (i) that the Reports of the Division Presidents and the Chairman of the Clinical Chemistry Section be approved, and a

- vote of thanks be recorded to these persons;
- (ii) that changes in atomic weight value for nickel and rhenium recommended by the Commission on Atomic Weights during the XXVII Conference be approved;
- (iii) to approve the appointment, in collaboration with IUPAP, of a neutral group of experts to consider the claims for priority of discovery of elements 104 and 105;
- (iv) to defer to a future meeting the possible adoption of a systematic nomenclature for elements after 105;
- (v) that a change in title from 'Section on Industrial Fermentation' to 'Section on Fermentation' be approved.

Minute 14 Report of Committee on Teaching of Chemistry

The printed report of the Committee on Teaching of Chemistry was included in the Council file. The Chairman, Prof. PARRY, referred to

- the troubles encountered in organizing the Wrocław conference on chemical education (1973) due to lack of understanding of the protocol requirements of UNESCO
- the good work of A. K. HOLLIDAY and R. MASKILL in editing *Survey of Chemistry Teaching at University Level* for IUPAC on behalf of UNESCO
- the wish to help introduce a simplified version of IUPAC nomenclature recommendations for use at the secondary level of education

He expressed concern at the apparent failure of many countries to make proper utilization of trained people from the present educational system. This concern was supported personally by the President of the Union and also by the French Delegation.

Minute 15 Report of Committee on Publications

The Chairman of the Committee on Publications, Sir HAROLD THOMPSON, said that the objectives of the Union's publications were

- to disseminate the reports of IUPAC bodies
- to stimulate future work
- to acquaint the general chemical public about IUPAC

He drew attention to

- the good income to the Union from increasing royalties
- the progress made in development of the *Information Bulletin* and its Appendices
- the discussions within the Committee on present and future policy
- the duty of the Union sometimes to provide its publications independently of financial considerations

Concerning policy, Sir HAROLD THOMPSON gave his personal view that IUPAC could not afford to make drastic experiments in its publications. He indicated that there would be some changes in wording of the report as finally printed in the *Comptes Rendus*.

In accepting the report, Council acclaimed Sir HAROLD for his work over several years as Chairman of the Committee on

Publications, from which Office he was now retiring.

Minute 16 Period of Office of IUPAC Treasurer

The German Delegation* proposed an amendment to the present period of Office of the Treasurer, namely that it should begin on 1 January of the year following his election at an IUPAC Conference, and end on 31 December of the year of the Conference at which his successor as Treasurer was elected. This would make the period correspond to the calendar year and bring it into line with the financial year.

The current Treasurer, Prof. HORN, said that when a new Treasurer presently took Office immediately after his election at Conference, he could not have any strong influence on the Union's finances for the remainder of the year and he was responsible for the accounts of the whole of that year.

Prof. BÉNARD advised that the 1965 Statutes and Bylaws did not include any specific statement about the period of Office of the Treasurer. However, because he was a Member of the Bureau, Statute 4.2 was applicable: 'Where the duration of office of Members of the Bureau, Division Committees, Commissions or other bodies of the Union is referred to in these Statutes, it shall begin and end at the end of a Conference.'

Council agreed that the proposal of the German Delegation should be referred for consideration during the current revision of Statutes. Subsequently, on the advice of the Executive Committee, it was decided to invite all National Adhering Organizations to submit their views on the matter in writing to the Secretariat by 1 November 1973. The Polish Delegation asked for all relevant information to be included with the invitation.

Minute 17 Adoption of Nomenclature Rules

The meeting file contained a list of tentative recommendations on nomenclature, symbols, units, and standards which had been approved by correspondence through the Executive Committee since the XXVI Conference. These tentative recommendations were ratified by Council.

On the proposal of the relevant Division President or Section Chairman, the following final (definitive) recommendations on nomenclature, symbols, units, and standards were approved by Council:

Physical Chemistry Division (Dr. WADDINGTON)

- (i) Recommendations for Presentation of Raman Spectra for Cataloging and Documentation in Permanent Data Collections (Commission on Molecular Structure and Spectroscopy) (tentative version in Tentative Nomenclature Appendix No. 11 to *Inf. Bull.*, February 1971);
- (ii) Recommended Names and Symbols for Light and Related Electromagnetic Radiation (Commissions on Physicochemical Symbols, Terminology, and Units, and on Molecular Structure and Spectroscopy) (tentative version in Tentative Nomenclature Appendix No. 24 to *Inf. Bull.*, June 1972);

*German Federal Republic

- (iii) Electrochemical Definitions and Symbols (Commission on Electrochemistry) (tentative version in Tentative Nomenclature Appendix No. 28 to *Inf. Bull.*, November 1972);
- (iv) Reprinting of the 1970 edition of *Manual of Symbols and Terminology for Physicochemical Quantities and Units* (Commission on Physicochemical Symbols, Terminology, and Units), to include (ii) above and minor revisions in the light of recent directives of the Bureau International des Poids et Mesures.

In answer to a question from the Hungarian Delegation, Dr. WADDINGTON said that the minor revisions should have little or no effect on Appendix II to the Manual on 'Definitions, Terminology, and Symbols in Colloid and Surface Chemistry—I', which had been published separately (1972).

Organic Chemistry Division (Prof. OURISSON)

- (i) Rules for Nomenclature of Quinones with Isoprenoid Side Chains (IUPAC-IUB Commission on Biochemical Nomenclature) (tentative version in *Inf. Bull.*, No. 25, February 1966, pages 24-31);
- (ii) Rules for Nomenclature of Carotenoids (Commission on Nomenclature of Organic Chemistry and IUPAC-IUB Commission on Biochemical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 19 to *Inf. Bull.*, February 1972);
- (iii) Abbreviations and Symbols for Nucleic Acids, Polynucleotides, and their Constituents (IUPAC-IUB Commission on Biochemical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 9 to *Inf. Bull.*, February 1971);
- (iv) Abbreviations and Symbols for Description of Conformation of Polypeptide Chains (IUPAC-IUB Commission on Biochemical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 10 to *Inf. Bull.*, February 1971);
- (v) Nomenclature of Multiple Forms of Enzymes (IUPAC-IUB Commission on Biochemical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 22 to *Inf. Bull.*, June 1972);
- (vi) Symbols for Amino Acid Derivatives and Peptides (IUPAC-IUB Commission on Biochemical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 23 to *Inf. Bull.*, June 1972);

Macromolecular Division (Prof. BENOÎT)

- (i) List of Abbreviations for Synthetic Polymers and Polymer Materials (Commission on Macromolecular Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 12 to *Inf. Bull.*, February 1971);
- (ii) Basic Definitions of Terms relating to Polymers (Commission on Macromolecular Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 13 to *Inf. Bull.*, February 1971);

Analytical Chemistry Division (Prof. KEMULA)

- (i) Recommendations on Nomenclature for Contamination Phenomena in Precipitation from Aqueous Solutions (Commission on Analytical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 14 to *Inf. Bull.*, February 1972);
- (ii) Recommendations on Nomenclature for Chromatography (Commission on Analytical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 15 to *Inf. Bull.*, February 1972);
- (iii) Recommendations for Nomenclature of Thermal Analysis (Commission on Analytical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 16 to *Inf. Bull.*, February 1972);
- (iv) Recommendations for Nomenclature of Mass Spectroscopy (Commission on Analytical Nomenclature) (tentative version in Tentative Nomenclature Appendix No. 17 to *Inf. Bull.*, February 1972);
- (v) Nomenclature, Symbols, Units and their Usage in Spectrochemical Analysis-III: Analytical Flame Spectroscopy and Associated Procedures (Commission on Spectrochemical and Other Optical Procedures for Analysis) (tentative version in Tentative Nomenclature Appendix No. 27 to *Inf. Bull.*, November 1972).

Clinical Chemistry Section (Dr. TONKS)

- (i) Quantities and Units in Clinical Chemistry (Commission on Quantities and Units in Clinical Chemistry) (tentative version in Tentative Nomenclature Appendix No. 20 to *Inf. Bull.*, February 1972);

Concerning 'catalytic amount' and 'enzymic activity', the Commission on Quantities and Units in Clinical Chemistry (CQUCC) had been unable to reach agreement with the IUPAC-IUB Commission on Biochemical Nomenclature. The latter's recommendations had already been published. Both points of view would now be mentioned by CQUCC.

- (ii) List of Quantities in Clinical Chemistry (Commission on Quantities and Units in Clinical Chemistry) (tentative version in Tentative Nomenclature Appendix No. 21 to *Inf. Bull.*, February 1972).

Minute 18 Bureau Proposals for New Bodies

Following the recommendations of the Bureau, which had been distributed to all Delegates, Council *Resolved*:

- (i) that, in accordance with the proposal of the Officers of IUPAC and IUB, the IUPAC-IUB Liaison Committee be dissolved and *ad hoc* Committees of experts be appointed in future to investigate specific problems as they arise;
- (ii) that, on the advice of the Organic Chemistry Division Committee, the Commission on Chemical Taxonomy be dissolved, the immediate tasks originally envisaged for it having been accomplished;

- (iii) that, further to the previous resolution of Council (Minute 16, page 61, *Comptes Rendus XXVI Conference*), the Section on Organic Coatings be transferred to the Macromolecular Division, where it will be attached as a Working Party on Supported Polymer Films;
 - (iv) that, on the advice of the Analytical Chemistry Division Committee, a Sub-Commission on Solubility Data be established and attached to the Commission on Equilibrium Data. The composition of the Sub-Commission is:
 - Prof. A. S. KERTES (Israel)
 - Prof. G. H. NANCOLLAS (USA)
 - Dr. C. L. YOUNG (Australia)
 - Prof. F. KOHLER (Austria)
 - Prof. R. BATTINO (USA)
 - Prof. O. KUBASCHEWSKI (Germany)
 - Prof. I. V. TANANAEV (USSR)
 - CODATA representative
 - Gmelin Institut representative
 - (v) that, on the advice of the Analytical Chemistry Division Committee, a Sub-Commission on Compilation of Stability Constant Data for Metal Complexes in Solution be established and attached to the Commission on Equilibrium Data. The composition of the Sub-Commission is:
 - Dr. D. D. PERRIN (Australia)
 - Dr. E. HÖGFELDT (Sweden)
 - Dr. H. OHTAKI (Japan)
 - Prof. K. B. YATSIMIRSKII (USSR)
 - CODATA representative
 - (vi) that, on the advice of the *ad hoc* Committee appointed by Council [Minute 18(ix), page 65, *Comptes Rendus XXVI Conference*], a Commission on Polymer Characterization and Properties be established. It should be attached to the Macromolecular Division, have six Titular Members, but be without additional expense to the Union during the next two years. The composition of the Commission should be recommended by the President of the Macromolecular Division.
- In answer to a question from the Polish Delegation, Prof. BENOÎT said that it was the intention to comprise the new Commission of the Chairmen of the three Working Parties responsible to it (see Minute 13), plus three other persons nominated by the Division Committee.
- (vii) that, on the advice of an *ad hoc* Committee appointed by the Bureau, a Commission on Physical Organic Chemistry be established. It should be attached to the Organic Chemistry Division, have eight Titular Members, but be without additional expense to the Union during the next two years. The Chairman of the Commission will be Prof. H. ZOLLINGER (Switzerland), who will make recommendations as to other Members.
 - (viii) that, on the advice of the *ad hoc* Committee appointed by Council [Minute 18(viii), page 65, *Comptes Rendus XXVI*

Conference], a Commission on Clinical Toxicology be established. It should be attached to the Clinical Chemistry Section and have four Titular Members. The composition of the Commission should be recommended by the Chairman of the Clinical Chemistry Section.

Following the recommendations of the Division Presidents and Chairman of the Clinical Chemistry Section, it was *Resolved* (Bylaw 4.1302):

that existing Sections, Commissions, and Sub-Commissions of the Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Macromolecular, Analytical Chemistry, and Applied Chemistry Divisions, and of the Clinical Chemistry Section, with the exceptions detailed above under (ii) and (iii), be allowed to continue for two more years.

In answer to an enquiry from the Israeli Delegation, the Executive Secretary said that the proposal for a Division of Nuclear and Radiochemistry had been discussed by the Division Presidents in Munich on 30 August. A recommendation would be submitted to the new Bureau at its meeting following the conclusion of the Council deliberations.

The German Delegation requested that, when the creation of new IUPAC bodies was proposed to Council in future, a definite period of existence be stated in each case.

Minute 19 Ratification of Decisions taken by Bureau and Executive Committee since XXVI Conference

All decisions taken by the two bodies since those approved by Council at the XXVI Conference, were contained in the Minutes of the XXVII-XXX Bureau and LXX-LXXV Executive Committee meetings. These Minutes had been circulated to all Delegates.

There was an extended discussion about the relationship between IUPAC and the Federation of European Chemical Societies (FECS) and especially of Resolution (i) of Minute 36.4/72 from the LXXIV Executive Committee meeting, in which the Delegations from Germany, Hungary, India, and Israel took part. After Prof. BÉNARD had read out the proposed wording of the official Minute to cover the discussions in Munich between the Executive Committee and Dr. R. E. PARKER of FECS (Minute 28.1/73, LXXVI/EC), Council *Resolved* (104 in favour; 2 against; 30 abstentions):

that the decisions taken by the Bureau and Executive Committee since the XXVI Conference be ratified.

Minute 20 Elections

Prof. BÉNARD announced the withdrawal by the Indian Delegation of the nomination of Prof. T. R. SESHADRI for the Office of Vice-President.

Present:

32 Delegations with a total of 136 votes.

Vice-President:

In a written and secret ballot for Dr. R. W. CAIRNS

130 in favour

6 against

Total voting 136, simple majority 69.

Dr. CAIRNS was declared the elected Vice-President, the result being greeted with acclamation by Council.

Elected Members to Bureau:

In a written and secret ballot (see Minute 4) for 8 vacancies

Prof. O. GLEMSER	134
Prof. S. RANGASWAMI	132
Prof. Sir DEREK BARTON	130
Prof. G. SMETS	128
Mr. P. M. Arnold	120
Prof. V. HEROUT	120
Prof. H. SUOMALAINEN	120
Prof. A. R. H. COLE	98
Prof. A. ABOU-EL-AZM	50
Dr. C. M. FERREIRA	34
Dr. T. A. RAFTER	22

Total voting 1,088, simple majority 69.

The 8 vacancies were declared to be filled by Prof. GLEMSER, Prof. RANGASWAMI, Prof. BARTON, Prof. SMETS, Mr. ARNOLD, Prof. HEROUT, Prof. SUOMALAINEN, and Prof. COLE.

The following elections of Officers made by the Divisions were approved by Council (Bylaw 4.105):

Physical Chemistry Division

President (1973-1977):	Dr. R. N. JONES
Vice-President (1973-1977):	Prof. S. SUNNER
Secretary (1973-1977):	Prof. M. FAYARD
[Past-President (1973-1977):	Dr. G. WADDINGTON]

Inorganic Chemistry Division

President (1973-1977):	Prof. V. GUTMANN
Vice-President (1973-1977):	Prof. L. MALATESTA
Secretary (1973-1977):	Prof. V. V. VLČEK

Organic Chemistry Division

President (1973-1975):	Prof. A. KJAER
Vice-President (1973-1975):	Prof. H. ZOLLINGER
Secretary (1973-1975):	Prof. P. YATES
[Past-President (1973-1975):	Prof. G. OURISSON]

Macromolecular Division

President (1971-1975):	Prof. H. BENOIT
Vice-President (1971-1975):	Prof. C. G. OVERBERGER
Secretary (1971-1975):	Prof. G. SMETS
[Past-President (1971-1975):	Prof. O. WICHTERLE]

Analytical Chemistry Division

President (1973-1977):	Prof. N. TANAKA
Secretary (1967-1975):	Mr. R. W. FENNELL
[Past-President (1973-1975):	Prof. W. KEMULA]

Applied Chemistry Division

President (1973-1977):	Dr. H. EGAN
Vice-Presidents (1973-1977):	Dr. W. G. STOLL
(1973-1975):	Prof. H. SUOMALAINEN
Secretary (1973-1977):	Dr. A. J. COLLINGS
[Past-President (1973-1977):	Dr. R. W. CAIRNS]

Minute 21 Ratification of Dates and Place of XXVIII Conference and XXV Congress

XXVIII Conference

Prof. BÉNARD said that invitations to host the 1975 IUPAC Conference had been received from Hungary, Israel, and Spain. Detailed information had been collected about holding the Conference in each of these countries. The Executive Committee and Bureau had considered the matter carefully and, besides taking into account the financial considerations, they believed it was a good policy to hold the two major biennial meetings of the Union—Conference and Congress—from time to time in different countries.

On the recommendation of the Executive Committee and Bureau, Council *Resolved* (102 in favour; 8 against; 16 abstentions):

that the XXVIII Conference of IUPAC be held in Spain during 1975, the exact location to be discussed with the National Adhering Organization in that country.

On behalf of the Consejo Superior de Investigaciones Científicas, the Spanish Delegation expressed delight that Council would come to its country in 1975. It hoped to make a preliminary announcement of the location in about two months. The Vice-President, Sir HAROLD THOMPSON, suggested that climatically and from the point of view of national Spanish holidays, it would be better to meet in the first two weeks of September rather than at the end of August. This would also avoid a clash of dates with the 1975 Fall Meeting of the American Chemical Society.

XXV Congress

The Israeli Delegation indicated that, in the light of recent and future discussions, minor changes were to be expected in the scientific programme as given in the Council file. In view of the present state of the arrangements, it was too late to change the dates (6-11 July 1975 at Jerusalem) nearer to those now proposed for the 1975 Conference.

Council *Resolved*:

that the decision to hold the XXV Congress in Israel during 1975 [Minute 24(i), page 68, *Comptes Rendus XXVI Conference*], be ratified, and that the proposed scope of the scientific programme be approved.

Minute 22 Place of XXIX Conference and XXVI Congress

XXIX Conference

Prof. BÉNARD said that no official invitation had yet been received

to host the 1977 IUPAC Conference. The Israeli Delegation made a verbal offer to act as the host country.

XXVI Congress

Council Resolved:

that an invitation to hold the XXVI Congress in Japan during 1977 be accepted.

Minute 23 Any Other Business

23.1 Opportunities for International Cooperation through IUPAC

Prof. BÉNARD said that the Statement of the US National Committee for IUPAC had been received too late for any decisions on it to be made by Council, but there could be discussion by the Delegates. He referred briefly to the deliberations on the matter by the Bureau (Minute 5/73, XXXI/B), and then invited Prof. C. G. OVERBERGER, Leader of the USA Delegation, to speak. Prof. OVERBERGER made the following points

- the US National Committee wished to express its confidence in the leadership of the Union
- there should be a mechanism in IUPAC whereby Council could aid in identifying and providing input to important problems of chemistry having direct impact on world problems
- attention had been drawn in the Statement to two broad areas which might be discussed at this time
- the US National Committee hoped to place on the agenda of the next Council a more definite suggestion of how IUPAC might be more effectively identified with world chemical problems

The Israeli Delegation expressed the hope that other National Adhering Organizations would also submit suggestions to the next Council for consideration of inclusion in IUPAC work programmes. Strong support for further consideration of the two broad areas identified by the US National Committee came from the Indian Delegation. The latter also supported the need to make better use of trained personnel (see Minute 14): 1-2 days might profitably be set aside at the next Conference to discuss possibilities under Statute 2.4. The Argentinian Delegate suggested that the Union could help to advise industrially developing countries on how best to avoid environmental problems.

23.2 XXVII Conference Banquet

The Treasurer, Prof. HORN, reported that out of 310 persons who had signified their intention to participate in the Banquet at Munich, only 174 had actually attended. The Hotel had made a charge of DM3,800 to cover the unfilled places. He proposed to invoice all those who should have attended.

Votes of Thanks

In closing the Council Meeting, Prof. BÉNARD expressed special appreciation to his fellow Officers, the immediate Past-President, and to the staff of the IUPAC Secretariat. Also, he

gave thanks to several prominent Members of IUPAC bodies, who were retiring after prolonged service on behalf of the Union: H. MALISSA, G. SATORI, F. D. ROSSINI. Finally with best wishes for his success, he handed over the Presidency to Sir HAROLD THOMPSON. The latter paid tribute to the great services which Prof. BÉNARD had rendered to IUPAC. The UK Delegation asked that a warm vote of thanks be recorded to the German hosts of the Conference.

ADDRESS OF INCOMING PRESIDENT AT CONCLUSION OF XXVII COUNCIL MEETING

In taking over this Office as President of IUPAC, I recognize the responsibility which falls upon me, but with the help of so many colleagues and friends I shall do my best to uphold the traditions and promote the welfare of the Union. Whilst not at all losing sight of our scientific objectives, I hope that we shall do what we can for the wider world community.

My immediate duty is to thank you, Prof. BÉNARD, for the great services which you have rendered. During the past two years, in particular, I have been able to observe at close quarters the immense care you have taken of the Union's affairs, and the delicacy with which you have made apparent difficulties disappear. Your distinction in your own special scientific field has been richly enhanced by your capacity to handle the business and the administrative requirements. While, to my personal regret, under the existing Statutes of the Union you cease to be what we call an Officer, it is fortunate for me that you will remain during my tenure as a Member of the Executive Committee, and I am sure that I shall call upon you for your experienced advice. We relieve you of some duties, but I can assure you that this does not mean entire release.

On behalf of all of us, I thank you most sincerely, and ask the Council to acclaim your work.

H. W. THOMPSON

COMMITTEE ON PUBLICATIONS

23 August 1973

Present: Prof. Sir HAROLD THOMPSON, Dr. L. C. CROSS, Dr. H. GRÜNEWALD, Dr. R. L. KENYON, Prof. A. PEREZ-MASIÁ, Prof. B. C. L. WEEDON (Scientific Editor). *In attendance:* Dr. M. WILLIAMS, Mr. P. D. GUJRAL.

1. Introductory Remarks

Sir HAROLD THOMPSON reported that two additional Members, with a general knowledge of the Union's business, had recently been added to the Committee by the President of the Union: Prof. A. PEREZ-MASIÁ (Spain) and Prof. G. OURISSON (France). He welcomed Prof. PEREZ-MASIÁ to the meeting. Prof. OURISSON could not be present because of a prior commitment in Sweden.

2. Minutes of Meeting in London (21 April 1972) and Matters Arising

The minutes of the previous meeting of the Committee on Publications [*Inf. Bull.* No. 44 (December 1972), pages 30-34] were approved.

The following matters arising from the minutes were considered further:

- (i) The Executive Secretary reported that during 1972 distribution of the article 'IUPAC—Aims, Structure and Mechanism' to the 44 member countries of the Union had been commenced by the Secretariat. Publication in full or in abbreviated form had so far taken place in 20 national chemical journals. Efforts were being made to ensure publication in the other countries. In addition, at the start of 1973 and after receiving professional advice, the brochure to assist extension of the IUPAC Company Associates Scheme had been printed and distributed.
- (ii) Sir HAROLD THOMPSON reported that the dispute between IUPAC and IUB about publication of the new report on *Enzyme Nomenclature* had been settled at a meeting of representatives of the two Unions in Stockholm on 10 January 1973. Publication of both soft- and hard-cover editions was being undertaken by Elsevier, with the copyright retained by IUPAC-IUB and the royalties shared equally between them. The situation should be reviewed at the 1974 meeting of the Committee on Publications, particularly the sales of the soft-cover edition which might have implications for IUPAC's nomenclature books issued through Butterworths.
- (iii) The final version of the Standing Orders of the Executive Committee regarding the Committee on Publications had recently been approved by the Executive Committee (Minute 11.3/73, LXXV/EC). The Committee on Publications decided to take the initiative in future by proposing names of persons suitably qualified for appointment as Members.
- (iv) Sir HAROLD THOMPSON reported that the first royalties from publication of *Argon* 1971 had been received earlier in 1973. During the IUPAC Conference in Munich, the Executive Committee would consider whether a proportion of these royalties should be placed at the disposal of the IUPAC Thermodynamic Tables Project Centre at Imperial College, London. The Committee on Publications registered its opposition to such action.

- (v) The views on future IUPAC publishing policy expressed by some Members of the Committee on Publications, especially the suggestion that *Pure and Applied Chemistry* and the *Comptes Rendus* be discontinued, had been considered at meetings of the Executive Committee and Bureau in Strasbourg during September 1972. There was general agreement by the Executive Committee and Bureau that the present publications should continue, and guidelines for the future proposed by Sir HAROLD THOMPSON had been approved. The major contribution from royalties on its publications to the income of the Union had been noted.
- (vi) Dr. KENYON reported on further selective experiments with audiotape at meetings of the American Chemical Society. Sales of cassettes were higher in 1973 than in 1972, which indicated an increasing awareness of and interest in cassette recordings. However, difficulty was still being experienced in respect of auxilliary lecture material, e.g., slides. ACS felt that the project was worth continuing on an experimental basis: although not particularly profitable, it covered the costs. Prof. WEEDON suggested that it might be worth considering to type up cassette recordings and sell the actual typescripts instead of the cassettes.

3. Report of Committee on Publications to Council

Brief consideration was given to the printed report to Council in Munich by Sir HAROLD THOMPSON as Chairman of the Committee on Publications. Some changes in wording of the report, as finally to be printed in the *Comptes Rendus*, were agreed. It was recommended that, in future, the tense of reports of all IUPAC bodies to Council should remain unaltered from that of the submitted manuscripts, but that the reports should carry the actual dates of their submission.

Further to a suggestion from Dr. CROSS, it was decided to consider, at the 1974 meeting of the Committee on Publications, the publication implications arising from the report to the Bureau in Munich of the *ad hoc* Committee on Nomenclature and Symbols.

4. Matters Arising with Butterworths

(i) *1972 Sales and Royalties*. After deductions for purchases by IUPAC of £5,195.21, the net royalty paid to the Union for 1972 was £9,724.48. IUPAC was now exempt from tax on its royalties from sales in UK.

The following points were emphasized by Sir HAROLD THOMPSON:

- (a) Compared with 1971 (£8,871.60), there was a considerable drop in the deductions for purchases by IUPAC. This reflected the requirement in 1972 that Company Associates should pay half the cost of their subscription to *Pure and Applied Chemistry* (PAC).
- (b) 'Industrial Waste Water' and 'Pesticide Terminal Residues' had sold well and gave indications as to the type of material to be selected for publication in the future.
- (c) Butterworths was being pressed to indicate whether the arrangements made in 1972 with Crane, Russak & Co. Inc. (New York) for distribution of IUPAC publications in North America, had been advantageous.
- (ii) *Renewal of Contract*. At the meeting of the Committee, it had been decided to extend the appointment of Butterworths, as official publisher to the Union, for one year at a time from 1 July 1972. Subject to the outcome

of discussions later in the meeting on the 1974 subscription for PAC, the Committee recommended that the contract be renewed until 30 June 1974.

The letter to Butterworths should mention the following needs:

- (a) to improve their international sales efforts;
- (b) to check that the present printers were the most economic;
- (c) to allow IUPAC to comment on proposed prices for all material to be published separately from the journal.
- (iii) *IUPAC Publications Meeting (21 March 1973)*. A report on an IUPAC Publications meeting at Butterworths, attended by Sir HAROLD THOMPSON and Dr. WILLIAMS, was considered briefly. Many of the matters were scheduled for further discussion during the present meeting. Dr. GRÜNEWALD was still unhappy at the title 'Additional Publication' for symposia material not previously published in the journal. Sir HAROLD THOMPSON suggested that the title be reviewed by the Committee in 1974. There was some support for the introduction of a series title to cater for data compilations not issued first in the journal. The Executive Secretary was requested to look up previous IUPAC deliberations on this subject for reconsideration in 1974.
- (iv) *Price and Frequency of PAC in 1974*. Butterworths' request to increase the subscription rate per volume of PAC to \$43.50/£14.50 in 1974 was accepted by the Committee on Publications. It would be recommended for approval by the Bureau. Sufficient material was scheduled for publication in 1974 to justify continuation of four volumes of the journal per annum. Prof. WEEDON reported that technical reports, other than on nomenclature, tended to arrive for publication without sufficient advance warning by IUPAC bodies. This caused problems in scheduling.
- (v) *Page Size for 1974*. At the 1970 meeting of the Committee, Butterworths had provided costs data to show that Metric Royal Octavo was the only reasonable alternative to the present Royal Octavo. The Committee agreed to change the page size of all IUPAC publications to Metric Royal Octavo in 1974.
- (vi) *New Covers and Jackets*. Further to discussions at the 1972 meeting of the Committee, three new dummy hard covers and two new dummy bookjackets from Butterworths had been circulated for comment. There had been general approval of the designs, including a revised jacket for 'IUPAC ADDITIONAL PUBLICATION'. They would be introduced for appropriate publications in 1973. A suggestion from Butterworths that the binding material for hard covers be changed to Balacron (vinyl coated) because it wears better and is cheaper, was approved.

A new front cover design for PAC, based on the new dummy dust jackets, had been accepted favourably by correspondence through the Executive Committee and Committee on Publications and it would be introduced in 1974. The Committee on Publications agreed to recommend that the Volume and Number details be moved from the top to the bottom of the new cover design. Butterworths had suggested that the style for text pages should also be redesigned. The Committee decided to request the publisher to submit its proposals for consideration.

- (vii) *Sales of Final Nomenclature Reprints by Secretariat.* From 1969 Butterworths was no longer required by contract to keep, for sale, 500 reprints of all reports of IUPAC bodies published in the journal. As an experiment in 1972, Sir HAROLD THOMPSON had agreed that the Union should purchase 250 reprints, for sale from the Secretariat, of three nomenclature reports likely to be of wide interest. The sales to date were judged to be satisfactory and the financial outlay might eventually be cleared.

After some discussion of the responsibilities of the Union in such matters, the Committee on Publications concluded that this service should be continued. However, because the publisher was unwilling to take any risk, Butterworths should be requested to sell the reprints to IUPAC at cost only and to provide a set of repros free of charge.

- (viii) *Status of Publications Programme.* Prof. WEEDON reported that the publications programme during the past biennium had been well executed. Only a single issue of PAC scheduled for 1971 had remained outstanding at the end of the year; the 1972 volumes had been cleared that year; and the volumes for 1973 were well advanced. In addition, substantial material had been published separately from the journal. It was pleasing to record the help, sometimes exceptionally good, received from Symposium Editors. The sterling work of Mr. BRIGGS and his colleagues at Butterworths should also be mentioned.

5. Information Bulletin and Its Appendices

- (i) *Price for 1974, including Continued Free Provision of Appendices on Request.* Paid subscribers to the Bulletin (and its Appendices) totalled 681 (as at 73.8.13), a 41% increase on last year. The increased subscription rates introduced in 1973 (\$9.00/£3.00—surface post; \$12.00/£4.00—Bulletin by air post, Appendices by surface post) would almost certainly cover unit costs of production and postage for the year. Therefore, the Committee on Publications agreed to keep the rates unchanged for 1974. It was decided to offer the possibility of receiving the Appendices by air post at an extra \$6.00/£2.00 per annum.

The servicing of requests for Appendices free of charge was reviewed, especially in view of the high unit production cost and postage of Tentative Nomenclature Appendix No. 31 (160 pages). Taking into account the overall financial surplus on IUPAC publications and pending the outcome of the deliberations of the *ad hoc* Committee on Nomenclature and Symbols, it was resolved to continue for the present the policy of providing free Appendices.

- (ii) *Policy on Publication of Material as Technical Report Appendices or in PAC.* No definite policy had been established as to when reports from IUPAC bodies should appear as Technical Report Appendices to the Bulletin and when in PAC. Some guidelines in the case of the Applied Chemistry Division had been suggested by Dr. H. EGAN. Several Members of the Committee on Publications pointed out that this problem could be not solved satisfactorily until the package of IUPAC publications had been definitely established long term. It was decided to reconsider the problem when the publications implications of the *ad hoc* Committee on Nomenclature and Symbols were clear. In view of present difficulties in locating where material had been pub-

lished by IUPAC, Dr. GRÜNEWALD suggested the advisability of preparing consolidated five-year indexes.

6. Review of Scheme for IUPAC News in National Chemical Journals

Since December 1971 the Secretariat had been distributing items of IUPAC news for consideration of publication in national chemistry news journals. At present (73.8.17) the news was being sent to 31 member countries of the Union; journals were under negotiation in 9 other countries; and no progress had been made for 4 countries. A selective survey (10 journals) had recently been carried out to ascertain which items had actually been published. In some cases there had been a good response to the IUPAC news. Journals which had not responded were being approached for the reason: Dr. GRÜNEWALD agreed to look personally into the case of *Nachrichten aus Chemie und Technik*. The Committee on Publications agreed to discontinue circulating summaries of the contents of each issue of the *Information Bulletin*, these having produced a negligible response. Drs. CROSS, GRÜNEWALD, and KENYON suggested that they should also receive future IUPAC news items, so that they could pass them to appropriate journals under their control.

7. Income-Expenditure Account for IUPAC Publications

At the request of the Treasurer, a detailed analysis of the finances of the whole IUPAC publication system had been made recently. The IUPAC publications Financial Statement for 1972 (as of 73.2.6) showed a surplus of over \$6,000. The Committee on Publications recommended that, in future, an income item be included in respect of a subsidy from general funds of the Union, to cover the costs of providing free *Information Bulletins* and their Appendices to Members of IUPAC bodies, etc.

COMMITTEE ON STATUTES AND BYLAWS

30 August 1973

Present: Sir DAVID MARTIN (Chairman), Mr. J. BROCARD, Dr. A. L. G. REES, Prof. H. SUOMALAINEN, Dr. G. WADDINGTON. *In attendance:* Dr. M. WILLIAMS.

1. Minutes of Previous Meeting

The minutes of the meeting of the *ad hoc* Committee on Statutes and Bylaws held in Washington, DC (22 July 1971), were approved without comment. Arising from those minutes:

- (i) Further action on the revised Analytical Chemistry Division Rules and the document 'Duties of Officers' had been deferred pending the current review of IUPAC Statutes.
- (ii) Sir DAVID MARTIN had submitted for consideration by the Executive Committee a draft Bylaw covering the privileges to be enjoyed by Associated Organizations. The draft was approved by the Committee on Statutes and Bylaws subject to minor changes of wording.

2. Standing Orders of Executive Committee Regarding Committee on Statutes and Bylaws

It was reported that two minor amendments to Composition and Terms of Office of the final Standing Orders had been agreed by the Executive Committee in Munich (Minute 36.1/73, LXXVII/EC).

3. Revision of 1965 IUPAC Statutes and Bylaws

President BÉNARD had inaugurated the revision of Statutes with a circular letter (72.10.11) inviting suggestions from Members of the Bureau, Officers of Standing Committees, and Division Presidents and Secretaries. Sir DAVID MARTIN said he had received a letter from the President in February 1973 giving the President's personal views on the Statutes. This raised important questions of reorganization and restructuring and Sir DAVID replied that the Bureau (Executive Committee) should take decisions on some other points raised and Statutes could then be drafted. In March 1973 the Executive Committee had met and concluded that evolution towards the revised structure should be sought by changes in the existing Statutes rather than wholesale revision. After discussion by the President and Executive Secretary with Sir DAVID MARTIN, two listings had been prepared:

- (i) Matters simply requiring changes of wording
- (ii) Matters requiring policy decisions

Proposals for changes in wording under (i) had been drawn up by Sir DAVID MARTIN and the Executive Secretary, and these would be considered at the present meeting of the Committee on Statutes and Bylaws. Matters under (ii) would be discussed by the Executive Committee at its meeting early in 1974. The recommendations arising therefrom would be drafted into the Statutes by the Committee on Statutes and Bylaws at a meeting in April 1974. The complete draft revision of Statutes could then be brought before the Bureau later in 1974, and circulated subsequently to the National Adhering Organizations ten months before the 1975 Council meeting (XXVIII IUPAC Conference).

In addition, Sir DAVID referred to:

- (i) Comments made by the Committee on Statutes and Bylaws on Standing Orders of the Executive Committee for various Standing Committees;
- (ii) A letter (March 1973) received from Prof. O. HORN about the period of office of the Treasurer, to which Sir DAVID replied that it was a matter for consideration by the Bureau of the Union.

3.1 *Matters Requiring Policy Decisions.* Although this listing was intended for discussion by the Executive Committee, some comments were recorded by the Committee on Statutes and Bylaws.

3.2 *Matters Simply Requiring Changes of Wording.* Subject to minor changes, the draft wordings were approved by the Committee on Statutes and Bylaws.

4. Date and Place of Next Meeting

The agreement reached by correspondence, that the next meeting would be held on 22–23 April 1974 at the IUPAC Secretariat, was reaffirmed.

COORDINATING COMMITTEE FOR ANALYTICAL METHODS FOR CEE AND IARC

August 1973

Present: Prof. R. TRUHAUT (Chairman), Prof. F. PELLERIN (Secretary), Prof. R. BELCHER, Dr. A. J. COLLINGS, Dr. H. EGAN, Dr. R. MARCUSE, Dr. H. GUTHENBERG.

I. Minutes of Previous Meeting

The minutes of the meeting at Kungälv on 24 August 1972 [see *Inf. Bull.* No. 44 (December 1972), pages 59–63] and of the Liaison Group at Paris on 10 April 1973 [see *Inf. Bull.* No. 46 (October 1973), pages 16–18] were approved.

2. IUPAC-CEE Contract for 1973

During the course of the meetings in Munich of Commission V.1 and of the Joint Meeting of Commission V.1 and Section VI.1, the report presented by Prof. PELLERIN concerning remarks made after circulation of the 1973 Contract methods was adopted. Four points remained to be considered.

- (i) Nine methods were adopted. They would be edited by Dr. COLLINGS, Dr. KAPEL, and Prof. PELLERIN in the recommended format and presented during the month of September 1973. They would be submitted to Prof. TRUHAUT at the beginning of October who would send them to Dr. EGAN and then to the Executive Secretary for transmission to CEE prior to 31 October 1974.

Six methods would not be sent to CEE. Four of them required further information which would be sought from CEE:

- Determination of Benzene in Diphenyl (9/73)
- Determination of Phenolic Derivatives in Diphenyl (11/73)
- Determination of Diphenyl Ether in Sodium *o*-Phenylphenate (12/73)
- Determination of *p*-Phenylphenol in Sodium *o*-Phenylphenate (15/73)

Two methods required further study by IUPAC specialists. Dr. HAENNI had suggested that it was necessary to seek clarification on the limits from CEE for:

- Polycyclic Aromatic Hydrocarbons in Water-soluble Colours (4/73)
- Polycyclic Acids in Benzoic Acid and their Sodium, Potassium, and Calcium Salts (6/73)

- (ii) It was recalled that the method 'Limit test for Selenium' had been sent to CEE under the terms of the 1972 Contract.
- (iii) The method 'Determination of Mercury in Food Additives by Colorimetry' had been sent in advance of the 1973 Contract. The method 'Limit Test for Arsenic', revised by Mr. MONKMAN, would be attached to the methods that were sent under the 1973 Contract.

A total of eleven methods featured in the 1973 Contract. Counting the methods already sent in excess under the 1972 Contract and preceding Contracts, the 1973 Contract would be fulfilled.

- (iv) Examination of methods sent to CEE under various IUPAC-CEE Contracts showed that the total requirements of CEE had been satisfied. For this reason a technical meeting between IUPAC and CEE was indispensable. The objective of the meeting would be to survey the work completed under the contracts for the control of purity criteria and to establish a list of further methods to be studied. Moreover, it would be convenient to envisage study of a group of methods relating to thickening agents, stabilizers, and emulsifiers, which up until now had not been considered by reason of the fact that the Scientific Commission of CEE had not established their purity criteria. This meeting would be held in Brussels in November 1973.

3. Liaison with CEE

Prof. TRUHAUT stated that the relations had been maintained by correspondence or in meetings with CEE representatives. It was apparent that CEE was in the midst of development and that it had not been possible to organize meetings at the level of its own experts or of joint IUPAC-CEE meetings. It was regretted that this state of affairs existed. Prof. TRUHAUT considered it vital to increase the subvention allocated under the terms of the contract.

4. 1974 Contract

The establishment of the list of methods would be decided at the IUPAC-CEE meeting. It was expected that the list would be established in March 1974 following the process used in previous years.

Amongst the studies that would be undertaken featured the determination of lead, copper, and cadmium by atomic absorption spectrophotometry. Details would be sent to Dr. MARCUSE by Prof. PELLERIN. Prof. TRUHAUT would ask Dr. GALLAY to send to Dr. MARCUSE information on the work carried out by his Working Group in SCOPE on Analytical Methods concerning the various metals mentioned above.

5. Cooperation with IARC

Prof. TRUHAUT gave an account of the state of affairs concerning cooperation with IARC. The studies undertaken in numerous works had been reassembled in a voluminous document which was in the course of finalization. The studies included, in particular, determination of polycyclic aromatic hydrocarbons in air and research on nitrosamines. The document would be published by IARC with mention of the participation of IUPAC.

6. Future Perspectives

In order to improve the effectiveness of the cooperative programme between IUPAC and CEE it was desirable that a meeting be held between the IUPAC experts and the representatives of CEE and of the governmental and health authorities in the Common Market countries to discuss the problems relating to control of the purity of additives. In harmonizing legislation, the representatives of IUPAC would go to Brussels to participate actively at such a meeting.

7. Composition of Committee

The Coordinating Committee proposed unanimously that Dr. P. L. SCHULLER (Netherlands) should become a Member of the Committee because of his

particular competence in food analysis and his membership of the Scientific Commission of CEE.

8. Any Other Business

Prof. BELCHER was requested to send to Members of Commission V.1 and Section VI.1 and the Coordinating Committee the recapitulation table (wall chart) of work carried out under the terms of IUPAC-CEE Contracts since 1967.

9. Next Meeting

The Liaison Group would meet in March 1974 in Paris or London to establish the list of methods for the 1974 Contract. Members of the Liaison Group would also meet on the day fixed for the technical meeting of IUPAC-CEE in November 1973.

FINANCE COMMITTEE

26 August 1973

Present: Dr. J. W. BARRETT (Chairman), Dr. E. M. BEAVERS, Prof. A. BJÖRKMAN, Mr. J. BROCARD, Dr. K. HOSHINO, Dr. R. MORE, Prof. O. HORN. The President, Vice-President, and Executive Secretary of the Union were in attendance.

I. Report on LXXV Meeting of Executive Committee

Whilst appreciating that it was advisory in nature and should not attempt to generate policy, the Finance Committee firmly believed that it could not effectively discharge its responsibilities for investments and for advice on short- and long-term financial matters without a full understanding of IUPAC policy and changes therein.

Dr. BARRETT drew attention to the following views of the Executive Committee, with which he personally agreed:

- (i) to seek statutory change so that Category D membership should not be entitled to voting rights, rather than imposing a limitation on tenure of such membership;
- (ii) that it would be contrary to the spirit of Bylaw 4.1303 to withhold travel and subsistence support from IUPAC for Titular Members of a country in arrears with its annual subscription.

With regard to the two items it had submitted for consideration in the revision of Statutes, the Finance Committee recommended that:

- (i) in order to extend participation of industrial members in IUPAC bodies without attracting travel and subsistence costs to the Union, the possibility of Associate Membership be permitted on all IUPAC bodies, particularly Division Committees;
- (ii) because no statutory change appeared to be necessary, the Bureau should ask Council in Munich to approve a change in present practice, so that the period of office of the Treasurer should commence 1 January in the year after his election at the biennial Conference. This would greatly facilitate a smooth transfer of responsibilities and full effectiveness from the date he took Office.

It was noted that the Executive Committee had not opposed the following recommendations of the Finance Committee:

- (i) that a return to regular transfers to reserves should be made in future biennia;
- (ii) that IUPAC should move to formalization of a separate publications account.

2. Budget for 1974

From information now available, Dr. BARRETT reported an increase in income of \$6,250 and decrease in expenditure of \$9,601 over the figures in the 1974 IUPAC Budget as drawn up on 31 July 1973. This reduced the anticipated deficit to \$1,360. Together with the Treasurer, he proposed limits of expenditure by IUPAC bodies in 1974 which would save \$17,696, and a further saving of \$2,500 by printing two instead of three *Information Bulletins* that year. These measures would lead to a surplus of \$18,836, which

was commensurate with recent practice to plan for a surplus of \$20,000 in a non-Conference year.

Sir HAROLD THOMPSON advised that the estimate for royalties from Butterworths (\$39,000) was too high. It should be based on four volumes of *Pure and Applied Chemistry* in 1973 and not on the five volumes published in 1972. A reduction in estimated royalties to \$36,000 was agreed, thereby reducing the anticipated surplus for 1974 to \$15,836. Because *Comptes Rendus XXVII Conference* would be issued in 1974, it was agreed that only two Bulletins need be published that year.

3. Financial Forecast for Biennium 1975-6

An increase in income of \$6,250 for both 1975 and 1976 should be included over that anticipated as of 31 July 1973 (see 2 above). Also, assuming that the new scheme for subscriptions from National Adhering Organizations (see later under 6) was fully effective by 1975, additional annual income of \$35,000 would be forthcoming. It was strongly advocated that this particular additional income should be used in 1975 to stimulate 'New and Extended Activities' of the Union. Recent investigations into the costs of holding the XXVIII IUPAC Conference (1975) in Hungary, Israel or Spain indicated that the limit of \$125,000 suggested for travel and subsistence was unrealistic.

The Executive Secretary was asked to investigate the basis for increasing royalties from Butterworths in recent years. If a main contributory factor was the increasing number of publication units, even higher royalties might result by requesting IUPAC bodies in future to provide more good reports for publication.

4. Review of Investments

Schweizerische Bankgesellschaft had provided a Statement of Securities (as of 20 July 1973). The recommendation of the IUPAC Banker not to make any changes at the moment was accepted by the Finance Committee. Instead, it was decided to evaluate the portfolio carefully at the meeting in 1974 with a view to suitable reinvestments.

5. Company Associates Scheme

- (i) Proposed wording for a new Statute to cover Company Associates was endorsed by the Finance Committee, with the suggestion that mention be made also of 'scientific societies'.
- (ii) The effect on soliciting new Company Associates of the brochure distributed to National Adhering Organizations at the start of 1973 was not yet clear. However, Switzerland had reported recently the acquisition of 16 membership units (\$4,000) for 1974.
- (iii) An exchange of correspondence about the future of the Organic Coatings Section in IUPAC had taken place between Prof. BJÖRKMAN and Dr. BARRETT. This led Dr. BARRETT to place before the Finance Committee two draft propositions concerning the attraction to and the use by IUPAC of industrial funds. Some modifications to the draft propositions were agreed by the Finance Committee, which decided to hold further discussions at its meeting in 1974. Prof. BJÖRKMAN and Dr. BARRETT were requested to prepare a paper to stimulate that discussion, taking into account the concept of 'New and Extended Activities' introduced into the 1975 Budget (see 3 above).

6. Subscriptions from National Adhering Organizations

Dr. BARRETT referred to his recently circulated memorandum which presented three possible new subscription schemes for the National Adhering Organizations.

Prof. BJÖRKMAN and Dr. BEAVERS favoured the separation of Company Associate income from National Adhering Organization contributions, because industry should not have to relieve countries of their financial obligations to the Union. However, it was felt to be impractical to introduce such a scheme at this time. Dr. HOSHINO suggested that the Company Associate subscription unit might be increased above \$250, but the Finance Committee as a whole was against such a move because it would not necessarily produce more income.

Concerning a recommendation to raise the basic unit of subscription to \$550, Sir HAROLD THOMPSON was concerned that the discrepancy between the subscriptions at the top (Category A3) and the bottom (Category C) was becoming too large. Dr. BARRETT pointed out that the overall cost of servicing a member country of the Union was now almost certainly above \$550 per annum. He suggested that the minimum subscription for Category C should be set specially at \$800 and the minimum subscription for Category A3 at \$50,000. This was approved by the Finance Committee and it was agreed to recommend a subscription scheme based on a \$550-unit to the Executive Committee.

The recommended scheme should enable the target of an extra \$35,000 from annual subscriptions to be reached no later than 1975. Nevertheless, even further income to extend and invigorate IUPAC activities would be necessary. The proposal favoured by the Finance Committee was to move progressively away from the current practice of counting Company Associate income towards the national subscriptions.

7. Additional Sources of Income for IUPAC

All IUPAC bodies had now been invited to draft proposals for projects in the biennium 1974-5, which might be suitable for attracting financial support especially from trusts and foundations. These proposals would be evaluated by the Executive Committee in conjunction with the Division Presidents.

8. Publications

The Finance Committee decided to move to formalization of a separate publications account. This would be done by introducing appropriate changes, in due course, into the format of the 1975 and 1976 IUPAC Budgets.

9. Membership

According to the Standing Orders of the Executive Committee regarding the Finance Committee, one Member of the Finance Committee must be replaced in 1973. Because nobody had yet reached the eight-year maximum period of membership, it was agreed to request the President to take a decision on the matter. The Finance Committee proposed the USSR nominee as a candidate for this vacancy. In order to avoid undue difficulties in future, the Executive Committee would be requested to revise clause (iv) of Composition and Terms of Office of the Standing Orders to read as follows:

'The President, in consultation with the Executive Committee, shall review the membership every two years and make changes to ensure continuity and effectiveness.'

10. Date and Place of Next Meeting

It was confirmed that the 1974 meeting would be held in Zürich on 18-19 February.

INTERDIVISIONAL COMMITTEE ON MACHINE DOCUMENTATION IN THE CHEMICAL FIELD

24 and 26 August 1973

Present: Prof. J. E. DUBOIS (Chairman), Dr. J. W. BARRETT, Prof. G. B. BOKII, Dr. J. J. B. VAN EIJK VAN VOORTHUIJSEN, Dr. C. SUHR, Dr. H. SCHENK. In attendance: Prof. S. FUJIWARA, Dr. R. N. JONES, Dr. A. K. KENT, Dr. W. H. POWELL, and the Assistant Secretary of the Union.

1. Minutes of Previous Meeting

The minutes of the meeting held in Paris on 15–16 October 1972 [see *Inf. Bull.* No. 45 (May 1973), pages 45–48] were approved. It was noted that Dr. F. A. TATE had accepted the principle of Registry Numbers assigned by CAS being freely used by the chemical community. Dr. POWELL informed the Committee that CAS had prepared a listing of these Registry Numbers, which was called the *Registry Handbook-Name Section* and contained some two million compounds arranged in ascending Registry Number order. This went with the system started by CAS in 1965. Details could be found in the CAS Catalogue *Information Services 1973* (page 9).

2. Membership

The President of IUPAC had discussed this matter with the Chairman and drawn his attention to the original recommendation for some Members to be directly involved in editorial programmes, especially primary and secondary publications. After a lengthy discussion, the Interdivisional Committee decided to replace Drs. BARRETT and JONES so as to take into account this recommendation. The Chairman thanked them for their participation in the Committee's work and hoped that the bonds already created would impel them to go on rendering their valuable aid to the Committee. After a thorough exchange of views, the following conclusions were reached in respect of replacements:

- (i) Dr. D. C. VEAL (UK Chemical Information Service) as Member and Secretary;
- (ii) Prof. S. FUJIWARA (Chairman of Japanese national research project on machine documentation) as Member.

Observers, ensuring essential contacts for the Committee with organizations outside IUPAC, would be Dr. BARRETT (IUPAC representative to ICSU AB) and Dr. JONES (as Vice-President of CODATA). The Committee proposed to invite Drs. L. C. CROSS, H. GRÜNEWALD, and K. L. LOENING as alternative Observers to participate in its work when this coincided with their particular fields of interest. During the present meeting Drs. CROSS, GRÜNEWALD, and LOENING were invited to join the Committee in its endeavours to define the desiderata and needs of primary literature within an integrated and evolving chemical information system.

Observers would participate only occasionally in Committee meetings. They would be kept informed of those specific tasks linked to their responsibilities, and their activities would entail no special financial measures.

In the course of this discussion it was emphasized that the Committee's activities regarding problems of computer storage included, of course, those

of input but also those of retrieval. It was oriented towards 'document retrieval' pointing to original articles as well as to 'information retrieval', whether data or structural retrieval. As such, it must survey all aspects of interrelationships between general nomenclature and index nomenclature in order to recommend maximum coherence between all the necessary steps going from authors to editors, then to users.

3. List of Documents Exchanged within the Committee

This list brought out the fact that the Committee had thus far concentrated its efforts primarily on standardization in the machine documentation field. It was noted that these efforts had been brought to bear on ISO, and that the work on codification had been the object of recent binational projects not yet recapitulated in sessions of the Interdivisional Committee.

4. Computing Documentation and Information

At the Paris meeting, it was agreed to have a summary prepared on the present world state of the subject under study by the Committee. Guidelines from this survey confided to Dr. VAN EIJK were defined in his report. The discussion revealed that the proposed project had several facets. Dr. VAN EIJK would receive the significant information passed on by Dr. BARRETT for ICSU AB and by Dr. JONES for CODATA. Concerning other outlooks, Dr. VAN EIJK would discuss his work plans with the Chairman.

It seemed particularly important to draw the attention of the chemical community to the information received. This would be done to communicate both problems studied by the Committee as well as important outside events in the field. For wide distribution two annual information documents condensed to 2-3 pages would be published in the *IUPAC Information Bulletin*. Dr. VAN EIJK, through these newsletters, would act as Editor for the Committee. In addition, an explanatory letter describing the aims and work programmes of the Interdivisional Committee would be sent to major organizations outside IUPAC to facilitate Dr. VAN EIJK's contacts with them.

5. Joint Meeting of ISO/TC 95 and ISO/TC 97 on Terminal Equipment

Mr. J. C. BONNET had represented IUPAC for Prof. DUBOIS at this meeting (Paris, 19-20 October 1972). Dr. R. WIGGINGTON (CAS) had previously represented the Union. It was accepted that IUPAC (*i.e.*, this Committee), would henceforth receive documents at the draft proposal stage for comment. A technical report was sent to all Members in due time, and it was decided to ask for critical comments from them about the ISO documents before the end of 1973 at the latest.

6. ICSU AB

Dr. BARRETT gave a brief report on ICSU AB and mentioned the existence of groups of experts in different fields. Chemistry was a fairly new one. He would see that the activities of this group were complementary with those of the IUPAC Interdivisional Committee, but felt that the tasks of the latter were oriented more towards chemistry, while those of ICSU AB tended to stress those needs outside chemistry. It seemed premature to detail these viewpoints because the ICSU AB chemistry group would prepare a statement on its terms of reference and intentions based on the results of an

enquiry to be launched from 1 October 1973. During the meeting, Dr. BARRETT presented an abstract of these documents to the Committee.

7. IUPAC Nomenclature Activities

At the Paris meeting it was decided that Dr. SCHENK would ensure liaison with Prof. N. LOZAC'H for problems of nomenclature. The LOZAC'H report and the documents with which he would shortly furnish the Committee, concerning new programmes in nomenclature, would be analyzed by him and sent to all Members for their comments.

8. Chemical Abstracts Index Names for Chemical Substances in 9th Collective Period (1972-76)

A long working session brought out CAS's desire to attain a 'unique non-trivial name'. This was obtained by using IUPAC nomenclature, albeit adapted at times; the principle of 'like treatment of like things' was found to cause problems in the rules by which a unique name was selected and had therefore been abandoned for the 9th Collective Period. Members would submit their observations to Dr. POWELL before 30 November 1973 on the techniques used by CAS in the choice of the 'most preferred name' of a given compound.

9. Stereochemical Nomenclature in 9th Collective Index and Stereochemical Notation in Coordination Chemistry Mononuclear Complexes

Dr. POWELL explained that these were draft reports and although they described the practices in the 9th Collective Period Indexes, they had not been approved for publication.

In a discussion of the occurrence of ring graphs in chemistry, a figure of about 8,000 recognized graphs (as of December 1970) and an acquisition of about 1,000 new ones a year could be considered a fair approximation of the state of the art. Coordination rings would not exceed several hundred (as of December 1972).

10. Automatic Determination of Rings

In the field of 'ring definition', Prof. DUBOIS summarized the methods proposed by FREREJACQUES, COREY and PETERSON, PLOTKIN, FUGMANN-DOLLING and NICKELSEN. The problem of differentiating between rings in the mathematical sense of the term and the chemical sense, which was that of documentation retrieval (compound retrieval or exhaustive specific substructure retrieval) were presented.

All Members concerned with this problem would present a report on 'Desiderata for Ring Description' from a qualitative point of view before the end of January 1974. Several Members had already proposed to reply (FUJIWARA, TATE, SUHR, SCHENK). Dr. SUHR mentioned that Dr. NICKELSEN felt that his proposed mathematical treatment of the basic problems of ring concepts had led to certain concepts which should be thoroughly discussed. The documents to be prepared should point to the advantages of certain models in view of either limited documentation or for more general purposes.

11. Unique Chemical Registry Record and Display of Chemical Structures

Dr. TATE had proposed at the Paris meeting to supply a report on 'Unique Chemical Registry Record'. The modular input technique retained allowed for the creation of a relatively complex structure on a CRT screen by selecting structural fragments from a 'menu list' of structural building blocks. Dr. POWELL mentioned the availability of the *CAS Reports* published by CAS (Number 2—April 1973). He would arrange for Members to receive this bulletin automatically.

12. Automatic Generation of Names

A general discussion was desired by all Members eager to know the latest developments. Although Dr. POWELL was not directly associated with the CAS project, he outlined certain of its trends and thought that it looked promising. This type of work could provide the topic of a 1-day seminar during the next meeting. The Chairman would discuss this with Dr. TATE, and under these circumstances a 3-day meeting rather than the usual 2-day one could be foreseen.

13. General Remarks about Nomenclature Publications

An inexpensive CAS publication of 140 pages, reprinted from the *Chemical Abstracts Index Guide*, outlined the general principles followed in the selection of index names for chemical substances by CAS in the 9th Collective Index (1972-76). Dr. KENT and other Members thought that documents of educational information value should be packaged for diffusion even at the level of fundamental courses.

14. Proposed Subtasks for Implementation of Recommendation on Machine Handling of Chemical Structures

The Chairman felt that, limited for time, the Committee had tended to work in the past on precise, urgent tasks, and he thought that in the future a thorough examination of the terms of reference should lead to formalizing its work methods. During this discussion it was observed that the technique of parallel reports should be used as a mechanism to formalize the Committee's working methodology. Diverse subtasks were proposed for implementation, but the document established by Prof. DUBOIS should only be considered as a stimulus.

After some discussion and bearing in mind the Washington report to the Bureau, the Committee agreed that all Members should establish for the end of September 1973 a report of suggestions either on the project already begun or, preferably, taking into account the 'desiderata of primary and secondary literature and of the users'.

All the replies would be evaluated rapidly, and this analysis ought to enable the Committee to establish procedures for the organization of the work and the presentation of the minutes. Members' reports would be sent simultaneously to all Committee Members. It was also mentioned that the 'nation state of art' reviews, as suggested in Washington, might be another good mechanism for defining better future planning.

15. Proposal for Codification of Chemical Formulae for Digital Computer Use

After the report of two Members of the Committee, the general impression was that the proposal did not establish any new principles. A letter stating the reception of this proposal would be sent to the authors, G. H. CHEESMAN and A. J. T. FINNEY.

16. NATO/CNA Advanced Study Institute on Computer Representation and Manipulation of Chemical Information (Noordwijkerhout, June 1973)

The Chairman introduced a paper, in which he noted that there were essentially four major interest groups amongst the attendees, *i.e.*, chemical documentation, computer-aided synthesis, graphics, identification of chemical structures. Because of the mass of detailed discussion on the major topics, it was difficult to detect or follow up on general problems. Nevertheless, certain preoccupations were evident, notably the problem of the unique form of structure representation and the control position of topology in structure description. There were encouraging signs that the various systems of structure description (*e.g.*, fragmentation, linear notation, topology) were being considered as complementary rather than competitive. Many participants highlighted the interest in description and indexing of reactions and there was some feeling that this area might prove of more fundamental interest than the description of compounds.

17. Man-Machine Communication for Scientific Data Handling (Freiburg im Breisgau, July 1973)

The Chairman introduced a paper on this meeting organized by the CODATA Task Group on Computer Use. He noted that there was a view that effective data and structure retrieval was already within the state-of-the-art, merely requiring adequate funds for effective application. Dr. SUHR, Prof. DUBOIS, and other Members had doubts whether this was so. Thus, there was no systematic presentation of data in the primary literature, nor an adequate set of agreed procedures for encoding and storage of such data normally expressed in a graphical form (*e.g.*, spectra).

18. Various National Experiences in the Chemical Field

Prof. FUJIWARA presented two papers. In the first he identified certain areas in which he felt the Committee might find problems deserving of more detailed study. In the second he highlighted some specific problems under active investigation in Japan.

A wide-ranging discussion followed. Amongst the points touched on were:

- (i) Dr. VAN EIJK noted that EUSIDIC and ASIDIC were much preoccupied with a number of the problems mentioned by Prof. FUJIWARA in his first paper. Dr. KENT suggested that a formal link with these organizations might help the Committee in its work.
- (ii) Dr. SUHR doubted whether analysis of queries would be of much benefit in identifying areas of special interest to users. Other Members of the Committee felt that such an analysis would be valuable, especially because it was important, as Prof. FUJIWARA had noted, to pay a great deal of attention to user needs.

- (iii) Prof. DUBOIS noted that the Committee had not, so far, paid any attention to the problems of automated structure assignment from analytical data. The form of structure descriptions adopted by systems must have a substantial impact on their use in this area. Prof. DUBOIS suggested that Members might consider this point in preparing the paper they would each submit concerning subtasks to be undertaken.

In thanking Prof. FUJIWARA for his papers, which had stimulated so much useful discussion, Prof. DUBOIS suggested that Prof. FUJIWARA might amplify and develop the papers for further consideration by the Committee.

19. Data Flagging

A letter from Prof. D. N. HUME, Chairman of an Analytical Chemistry Division *ad hoc* Committee on Data Flagging, seeking advice and opinion on a proposal to flag the presence of numerical data by use of a two- or three-letter code was discussed. Members felt it was, from the machine-documentation point of view, more important to demonstrate a need for such flagging by, for example, itemizing the desiderata for a flagging system, rather than proposing a specific solution which, in any event, seemed to be essentially an aid in visual scanning only. Members felt that they could make useful comments only if they were given some indication of what specific purpose the flagging system would serve. They could then suggest ways in which it might be most effectively handled by mechanized systems.

20. Date and Place of Next Meeting

It was agreed that, subject to the convenience of CAS, the next meeting of the Committee should be held at Columbus, Ohio, around the middle of October in 1974. Because Members hoped to have an opportunity to hear about the latest activities of CAS in the field of handling chemical nomenclature, it seemed desirable to have the meeting extended over 3 days.

INTERDIVISIONAL COMMITTEE ON NOMENCLATURE AND SYMBOLS

21 and 26 August 1973

Present: Prof. W. C. FERNELIUS (Acting Chairman), Prof. H. M. N. H. IRVING (Secretary), Dr. R. DYBKAER, Prof. O. HOFFMAN-OSTENHOF, Prof. N. LOZAC'H, Dr. K. L. LOENING, Dr. M. A. PAUL, Prof. S. J. PIRT.

1. Arising out of the Minutes of the previous Meeting (Washington, 22 July 1971, see *Comptes Rendus XXVI Conference*, pages 91-93), the Committee noted the following points:
 - (i) The request (Minute 6) for all IUPAC publications on nomenclature to be provided *gratis* to every Chairman, Secretary, and Titular Member of each relevant Commission had been refused. The Executive Secretary had made it clear any such documents must be purchased with the approval of the Division President from the Division Contingency Fund. The Committee again stressed the point that it could not fulfil its functions if all appropriate nomenclature documents were not made available to each of its Members.
 - (ii) The Secretary drew attention to Item 11 and Prof. PIRT reported on the extent to which the proposals to produce simplified versions of nomenclature had progressed. It was generally agreed that the primary difficulty was that of finding sufficiently interested and knowledgeable persons who had time to work in this field.
2. The Secretary reported that a proposal by the Swedish Chemical Society to reformulate the Periodic Table had been sent to the Interdivisional Committee through Prof. K. A. JENSEN. Prof. FERNELIUS ruled that this did not come within the Committee's terms of reference.
3. Copies of the Second Revised Report of the *ad hoc* Committee on Nomenclature and Symbols, set up by the President after the Washington Conference, were laid on the table. The Secretary stated that this *ad hoc* Committee consisted of Profs. FERNELIUS, HOFFMAN-OSTENHOF, MCGLASHAN, and WEEDON, under the Chairmanship of Prof. LOZAC'H, with the following terms of reference (i) to review the whole area of IUPAC nomenclature activities; (ii) to recommend policies for adoption; (iii) to recommend the composition and terms of reference of a broadly-based supervisory body with executive powers to implement the recommended policies.
4. It was appreciated that this Report did not represent an agreed opinion of the whole *ad hoc* Committee. Members of the Interdivisional Committee deplored the fact that it made no specific reference to the various proposals minuted by the Interdivisional Committee after long discussions at its Washington meeting. It was felt that progress in reorganizing the present Committee or establishing a new one would be still further delayed if the Report to the Bureau was insufficiently explicit or comprehensive. Prof. LOZAC'H indicated that any discussion of his Report could be useful and might form the basis of an addendum or revision of the actual report, which he would present to the Bureau in Munich.
5. The Committee then proceeded to a detailed discussion of the proposals contained in Section II (Proposed Organization) of Prof. LOZAC'H's Report. Their deliberations in no way changed the intent of the original

proposals but were confined to making them explicit and unambiguous. The final proposals were given in full in an Addendum entitled 'Proposed Organization of the Interdivisional Committee on Nomenclature and Symbols'. Prof. LOZAC'H said that he felt the considered opinion of the Interdivisional Committee as embodied in the Addendum would be of value to him in presenting his Report to the Bureau.

6. The Secretary stated that he had written personally to the President expressing concern that the present Interdivisional Committee was still without clear terms of reference and the executive powers requested before and at the meeting in Washington two years ago.
7. In the course of general discussion, Members commented freely on the lack of effective publicity given to IUPAC nomenclature documents and various suggestions were made how editors of journals could assist in the dissemination of information and the promotion of uniform practice in nomenclature. Prof. FERNELIUS suggested that whenever an author found it necessary to invent new nomenclature there should be a footnote in the paper in which it was first published, stating that the proposed new nomenclature was only tentative and had not yet received the approval of IUPAC.

SECTION ON CLINICAL CHEMISTRY

27 August 1973

Present: Dr. D. B. TONKS (Chairman), Prof. P. LOUS (Vice-Chairman), Dr. M. ROTH (Secretary), Prof. D. H. CURNOW, Prof. R. GRÄSBECK, Prof. P. MÉTAIS, Prof. F. W. SUNDERMAN, Jr. (Titular Members); Prof. H. BÜTTNER, Prof. A. DEFALQUE, Prof. J. FREI (Associate Members); Dr. R. DYBKAER, Prof. M. RUBIN, Prof. T. P. WHITEHEAD (Commission Chairmen); Prof. E. KAISER, Dr. R. S. MELVILLE, Dr. F. L. MITCHELL, Dr. J. C. NIXON, Dr. R. ZENDER (National Representatives); Dr. B. H. ARMBRECHT, Dr. C. J. PORTER, Prof. D. STAMM, Prof. H. A. TAWFIK (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting held in Copenhagen on 19 June 1972 [see *Inf. Bull.* No. 44 (December 1972), pages 49–51] were approved.

2. Chairman's Report to Council

An important decision of the Bureau had been to approve the report recommending establishment of a Commission on Clinical Toxicology. Several Members of the Section attended the International Conference on Standardization of Diagnostic Materials in Atlanta, Georgia, sponsored jointly by WHO and the US Center for Disease Control. Close ties between IFCC and the Section had been maintained during the past two years.

The Report to Council was approved. In the discussion, it was suggested that IUPAC should consider to change the Clinical Chemistry Section into a Division. This would be justified by the growing importance of the activities of the Section. A formal proposal for this change was passed for presentation to the Bureau.

3. Report of Commission on Automation

Commenting on the 'Glossary of Terms used in Automatic Analysis' which had been produced by the Commission, Prof. WHITEHEAD explained that some imperfect terms were indeed very useful for the communication of ideas, but were extremely difficult to translate into a correct definition. Another document entitled 'Recommendations concerning Automated Quantitative Analysis in Clinical Chemistry' had required much time to be prepared, but it was now close to being issued in its approved form.

The question of whether the scope of the Commission on Automation should not be extended to include evaluation of instruments, or even whether an additional Commission should be created on this subject, was discussed. Prof. RUBIN mentioned that the recent WHO-sponsored meeting in Atlanta on standardization of diagnostic materials had evidenced the need for devising criteria and standards for the evaluation of analytical instruments, a task which WHO was hardly able to perform alone. According to Prof. LOUS, WHO would certainly welcome assistance from IUPAC in this matter.

The urgency of setting up a working group dealing with these questions was evident to all participants. A close cooperation with the Analytical Chemistry Division appeared indispensable. However, because some of the instruments in question were specific to the clinical chemistry laboratory, this matter should obviously be dealt with in the Clinical Chemistry Section.

The following motion was unanimously accepted:

'It is proposed that a Commission on Clinical Chemistry Instrumentation be formed as soon as possible.'

4. Report of Commission on Quantities and Units

The work of the Commission was presented by Dr. DYBKAER. His report (30 May 1973) was accepted. The texts of two documents [Tentative Nomenclature Appendices Nos. 20 and 21 (February 1972) to the *Information Bulletin*] were being revised and should be ready for publication in final form within a few months.

A German translation of Dr. DYBKAER's paper on quantities and units was being prepared jointly by the German, Swiss and Austrian Societies of Clinical Chemistry. A French translation had been published.

The Commission had held a useful joint meeting in Munich with the Commission on Physicochemical Symbols, Terminology, and Units. The following items were discussed:

- (i) A pending problem was to find a name for the kind of quantities related to the mass of the containing substance (mol/kg). 'Content' presented difficulties of translation into French and German. Suggestions would be welcome.
- (ii) It was again stated that 'normality' and 'val' were superfluous.
- (iii) ISO had recently recommended the comma as a decimal sign for international use, and this would be used in the Commission's Recommendations 1973.

There had been much trouble with enzyme units, because biochemists (and IUB) insisted on having a unit (katal) to express 'enzyme activity', which was correct, but would also like to derive a concentration from it (activity divided by volume) which, in fact, could not be considered as a concentration, as the physicochemists confirmed it. Despite these objections, an unsatisfactory version of recommendations had now been approved by IUPAC-IUB. It had been suggested that the Commission make its own proposal. Of course, if the katal was used either as an activity or as a quantity of enzyme, the figures would be the same.

It was decided that the Commission should publish its views on the subject. Further, the Section approved the final versions of recommendations based on TNAs Nos. 20 and 21. The question now was to decide where and how these recommendations should be published. *Pure and Applied Chemistry* would be the normal medium, but it seemed appropriate, to ensure a wide distribution, to publish the text also in the form of a monograph, or, as the Commission preferred, to use the space which was now in the process of being allotted to IFCC in *Clinica Chimica Acta*. In the latter case, the copyright should be owned by the Section, so that the text could appear also in the IUPAC journal or Bulletin. Dr. DYBKAER suggested that the Chairman should discuss with the necessary IUPAC authorities the most appropriate way of publication.

Further projected activities of the Commission included the preparation of recommendations on

- (i) optical spectroscopy in clinical chemistry;
- (ii) relative activity, pH, kinetics;
- (iii) rheological and surface phenomena.

There was also a need for a dictionary of quantities and units in the whole field of chemistry. The following motion was approved by the Section:

'The many separate documents on nomenclature issued by IUPAC have made overview and reference increasingly difficult. It is, therefore, proposed that a comprehensive glossary of recommended scientific terms, abbreviations, and symbols be compiled and published by IUPAC.'

5. Report on Commission on Teaching

After two reports of the Commission had been accepted, Prof. RUBIN reported on the work done during the Munich meeting. A second draft of the monograph being prepared on 'Teaching in Clinical Chemistry' had been entirely reviewed. It included sections on the history of clinical chemistry, on the functions of the clinical chemist, and on education and training of the senior staff, and a set of recommendations. The status of the subject in the various countries would be presented in an appendix. A copy of this draft had been sent to the Committee on Publications of IUPAC. The finalized text was expected to be ready for printing by January 1974.

The Commission had held a fruitful joint meeting in Munich with the Officers of the Committee on Teaching of Chemistry of IUPAC, in which interaction between chemistry, biochemistry, and clinical chemistry on questions of teaching was discussed.

6. Elections

Prof. LOUS was nominated Vice-Chairman and Chairman Elect for the next two years. Dr. DYBKAER and Prof. WHITEHEAD were proposed as new Titular Members of the Section, following a recommendation of the IUPAC President that Commission Chairmen should if possible be made Members of the Section. They would succeed Profs. LATNER and MÉTAIS who were now elected for two years as Associate Members of the Section.

Prof. H. BÜTTNER (Federal Republic of Germany) and Prof. M. HJELM (Denmark) were proposed as new Titular Members of the Commission on Automation in replacement of Drs. SANZ and JØRGENSEN who had both resigned. Dr. J. BIERENS DE HAAN (Switzerland) was nominated as an Associate Member of the same Commission. Mr. J. C. RIGG (Netherlands) was proposed as a Titular Member of the Commission on Quantities and Units, replacing Dr. JØRGENSEN. Prof. D. H. CURNOW (Australia) was nominated a Titular Member, and Drs. C. J. PORTER (Canada) and M. SCHWARTZ (USA) were nominated as Associate Members of the Commission on Teaching.

7. Collaboration with WHO in Certain Areas

On behalf of IUPAC, Dr. ROTH had attended the WHO Expert Committee meeting on Environmental and Health Monitoring in Preventive Occupational Health Practice (Geneva, 31 July-6 August 1973). There was growing interest to establish standards on an international basis for the evaluation of preliminary signs of potential hazards in industry and other working areas. IUPAC could be of assistance to WHO in providing information on chemical assay methods and other related material. One problem was the necessity of being able to compare results from different laboratories in the world. The report of the Expert Committee would be published by WHO later in the year.

8. Interdivisional Committee on Nomenclature and Symbols

Dr. DYBKAER reported on the unsatisfactory situation of this Committee. Its Members felt frustrated because it had no terms of reference, no authority, and no knowledge of its future. The following motion was therefore proposed and accepted:

'The large area of interest covered by the various nomenclature bodies of IUPAC leads to divergent trends with the present way of producing recommendations. All groups concerned would benefit if inconsistencies, opposing views, and unnecessary duplications could be detected early and eliminated.'

The Section of Clinical Chemistry suggested that an Interdivisional Committee on Nomenclature and Symbols (possibly evolved from the present body of the same name) be given a broadly representative structure with connections to other international organizations, to editors of journals, and to industry. The Committee might be subdivided to cover:

- (i) nomenclature and symbols of quantities and units, and definition of terms,
- (ii) nomenclature of chemical compounds.

The functions of the Committee would be to help the individual nomenclature Commissions when they set up new programmes by ensuring adequate contact with other bodies and avoiding duplication and inconsistencies; to review manuscripts before publication in order to point out conflicts with existing nomenclature and to mediate between the parties involved; to suggest a decision to IUPAC of matters not resolved by that mediation; to suggest to IUPAC new activities in the field of nomenclature; to prepare material and issue recommendations integrating the views of the different Commissions in a consistent form.

9. Commission on Toxicology

Prof. SUNDERMAN presented a report summarizing the tasks and work of any future Commission on Toxicology, the formation of which would be submitted to Council in Munich for approval. The principal concerns of the Commission would be:

- (i) chemical methods for detection and quantitation of toxic agents in body fluids, tissues, and excreta of man;
- (ii) assessment of biochemical effects of toxic agents by measurements of enzymes and metabolites in human body fluids;
- (iii) international agreement concerning reference intervals for diagnostic tests in toxicology, as well as for critical values which are based on measurements of body fluids or excreta, and which are used in indices of environmental or industrial exposures to toxic agents.

It was thought that one of the first activities of the Commission would be the standardization of atomic absorption spectrometry of metal traces in body fluids and tissues.

10. Future Meetings

A meeting gathering together the Section Officers and Commission Chairmen, plus meetings of the Commissions on Automation and on Quantities and Units, were planned for 1974 in Munich, either before or after the European Congress of Clinical Chemistry (22-26 April).

COMMISSION ON AUTOMATION

21-22 August 1973

Present: Prof. T. P. WHITEHEAD (Chairman), Dr. D. S. YOUNG (Titular Members); Prof. H. BÜTTNER (Associate Member); Dr. B. H. ARMBRECHT, Dr. R. S. MELVILLE, Dr. J. C. NIXON (Observers).

1. The Commission continued its discussion of the document 'Recommendations Concerning Automated Quantitative Analysis in Clinical Chemistry'. It was agreed that this document, after the insertion of modifications and agreed additions, should be circulated and then presented informally to colleagues by Commission Members.
2. It was agreed only to include definitions of terms actually used in the Commission documents in the 'Glossary of Terms'. Agreement had been reached with the Commission on Analytical Nomenclature on the following terms: 'Automate', 'Automatic', 'Automation', 'Automatize', 'Instrument', 'Instrumental', 'Instrumentation', 'Machine', 'Mechanical', 'Mechanisation', 'Mechanism', 'Mechanise', 'Result'.

Tentative agreement on the following terms was reached with the Commission on Analytical Nomenclature:

Carryover. Contamination of a sample or reagent or both in a system by material from a previous operation.

Data Input. The process of putting data into equipment.

Data Output. The process of taking data from equipment.

Drift. A systematic change in signal with time.

Feedback. A combination of a sensing and a commanding device which can modify the performance of a given act.

Loading Zone Capacity. The maximum number of specimens that can be handled by a particular sampling system without intervention from the operator.

Monitor (verb). The continual observation of a system.

Noise. The random fluctuations occurring in a signal that are inherent to the combination of instrument and method.

Program (noun). A means for instructing a device to perform action.

Program (verb). To provide a set of instructions requiring a device to perform action.

Sample. Is that appropriately representative part of a specimen which is used in the analytical procedure. It is usually a measured amount.

Specimen. Is the material available for analysis.

3. It was decided to avoid formal definition of the following terms: 'Specimen Contamination', 'Throughput Time', 'Channel', 'Continuous Flow Analysis', 'Discrete Analysis'.
4. It was agreed that the Commission should await the deliberations of the Expert Panel on Nomenclature and Principles of Quality Control of the IFCC Committee on Standards regarding the following terms: 'Precision', 'Accuracy', 'Within Series Precision', 'Between Series Precision'. In the meantime, the definitions of precision and accuracy of the Commission on Analytical Nomenclature should be used.

5. As part of the discussions at this meeting the Commission became aware that the following terms required formal definition. The first attempt at such definitions was given:

Report (the meaning in Clinical Chemistry and as distinct from a result). A combination of patient information, specimen information, and a result which had been edited on the basis of such information as the laboratory's current quality control information. The report may contain interpretive data such as a comparison of the observed quantity with reference values.

Sampler. A device for taking and delivering a defined volume of a specimen.

Dispenser. A device for taking and delivering a defined volume of a liquid.

Sampler Diluter. A device for taking a defined volume of a specimen and also a defined volume of a diluting liquid and delivering them.

6. It was decided that the above proposals, as necessary, should be sent to the Secretary of the Commission on Analytical Nomenclature for consideration and approval.
7. Regarding detailed work on the document 'Evaluation of Instruments for Automatic Analysis in the Clinical Chemistry Laboratory', Dr. YOUNG dealt with the first part and would send this to Commission Members. Prof. WHITEHEAD agreed to do the same for the second part.
8. It was agreed that the next meeting should be held just before the European Congress of Clinical Chemistry in Munich during April 1974.

COMMISSION ON QUANTITIES AND UNITS (CQUCC)

24–28 August 1973

Present: Dr. R. DYBKAER (Chairman), Dr. B. H. ARMBRECHT, Prof. R. HERRMANN, Prof. P. MÉTAIS (Titular Members).

1. These sessions were to be considered as a joint meeting of CQUCC and of the Expert Panel on Quantities and Units (EP on QU) of the IFCC Committee on Standards.

2. The minutes of the previous meeting [Copenhagen, 16–17 June 1972: see *Inf. Bull.* No. 44 (December 1972), pages 44–48] were approved, subject to the amendments of 1972.11.13.

3. Prof. HERRMANN reported that Austria, Switzerland, and Federal Republic of Germany had decided to cooperate on a German translation of a paper on quantities and units by R. DYBKAER [*Standard Methods of Clinical Chemistry*, 6, 223–244 (1970)]. Joint meetings in Basle (1973.3.24) and Strasbourg (1973.4.17) had tried to solve the difficult problems of translation. The document should be finalized next month. A German problem was that there were two competing trends in nomenclature (Normenausschuss and Eichamt) and that DDR did not participate.

Prof. MÉTAIS reported that a French Commission on Quantities and Units had been formed and had connections with Association Française de Normalisation. The Commission would cooperate with an analogous Swiss group and the Germans.

4. The several publications on Quantities and Units in Clinical Chemistry had been listed in the Activity Report of CQUCC (1973.5.30) to the Clinical Chemistry Section. To this could now be added:

(i) BEELER *et al.*, *Amer. J. Clin. Path.* **59** 277–281 (1973), to which DYBKAER and JØRGENSEN have written a reply which had been accepted, but not yet published.

(ii) VAN ASSENDELFT *et al.*, *Pflügers Archiv*. **339**, 265–272 (1973), to which DYBKAER had replied in a personal letter to VAN ASSENDELFT because *Pflügers Archiv* does not publish letters to the Editor.

5. The detailed discussion of the amended versions of Tentative Nomenclature Appendices Nos. 21 and 22 (February 1972) to the *Information Bulletin*, led to some basic decisions and further corrections. Small changes would be evident from the final manuscripts. The more important points comprised:

5.1. Alternative units with the dimension one were deleted.

5.2. The decimal sign was changed from dot to comma.

5.3. Symbol subscript B was deleted.

5.4. The term 'mixture' was generally changed to 'system'.

5.5. The terms 'generic quantity name' and 'quantity' were preferred for 'unaddressed' and 'addressed' quantity, respectively.

5.6. Some kinds of quantities were renamed following the joint meeting with the Commission on Physicochemical Symbols, Terminology, and Units (I.1) (see later).

5.7. The term 'submultiples' of units was abandoned for 'multiples'.

5.8. The term 'noncoherent' unit was preferred.

5.9. The spelling of 'hemo' contra 'haemo' is not a recommendation.

- 5.10. Some codes and abbreviations for systems and kinds of quantity were revised.
- 5.11. The corrected Sections in TNA No. 20, 4.7 (Catalytic activity) and 4.16 (Catalytic concentration), would be rewritten in the light of the discussion with Commission I.1. The original version would be nearer to the final one than was the present corrected one.
- 5.12. Changes in TNA No. 21 were minor and mostly comprised what was incurred by the above decisions.
- 5.13. DYBKAER was charged with preparing the final manuscripts except for TNA No. 20, Sections 4.7 and 4.16, which should be approved by CQUCC.

6. The first draft manuscripts on emission and absorption spectroscopy presented (1973.8.22 and 1973.8.9) by HERRMANN and MÉTAIS, respectively, were discussed thoroughly as regards nomenclature, layout, and format (which was to follow that of IFCC-IUPAC Recommendation 1966). Examples of each kind of quantity should be taken from technology. Diagrams of spectroscopic types should be included. The deadline for second drafts was 1974.2.1.

7. The future work of the Commission was discussed thoroughly, including ARMBRECHT's question about pharmacodynamics and toxicology, MÉTAIS' about enzyme inhibitors, and HERRMANN's about mass spectroscopy, Auger spectroscopy, nuclear magnetic resonance, and electron spin resonance. It was decided that the tasks already outlined were sufficient at present: DYBKAER should finalize the two Recommendations 1972 and later work on rheology and related kinds of quantity, HERRMANN on the second emission spectroscopy draft, and MÉTAIS on the second absorption spectroscopy draft. ARMBRECHT's field should be discussed when the new fifth Member of the Commission had been confirmed in order to distribute the work load optimally; kinds of quantity related to activity and reaction kinetics were to be considered.

8. The format of future recommendations was considered. In general, the layout from the IUPAC-IFCC Recommendation 1966, Part 4, would be used with appropriate introduction.

The following booklets should be aimed at:

- (i) Spectroscopy—optical methods for clinical laboratories;
- (ii) Activity, pH, reaction kinetics, *etc.*;
- (iii) Surface phenomena, rheology, *etc.*

9. The items for discussion with Commission I.1 as suggested in a letter (1973.8.6) from DYBKAER were discussed thoroughly and approved. The plan to lay the problems also before the Interdivisional Committee on Nomenclature and Symbols was abandoned, because its Chairman reportedly had stated that the questions were not suitable for IDCNS.

10. The proposals to the IUPAC-IUB Commission on Biochemical Nomenclature (CBN) made in a letter (1973.7.3) by DYBKAER were approved primarily. Following the joint meeting with Commission I.1 (see later), the proposals would be amended as would appear from corrections to TNA No. 20, Sections 4.7 and 4.16. DYBKAER would inform CBN accordingly.

11. DYBKAER reported that IFCC might soon have access to a separate 50 pages per year in *Clinica Chimica Acta*. The Commission felt that this

would be the best (additional?) place for the two Recommendations 1973 in order to reach clinical chemists.

12. The Membership was discussed thoroughly. Dr. K. JØRGENSEN's decision to withdraw from the Commission due to overwhelming work load was regretfully accepted and he was accorded a vote of thanks for his important contributions to the work of the Commission.

The remaining four Titular Members were already elected until 1975, when ARMBRECHT, DYBKAER, and MÉTAIS would have served eight years, whereas HERRMANN could then be elected for a second period of four years. It was envisaged provisionally that ARMBRECHT and MÉTAIS might leave the Commission in 1975, HERRMANN would continue, and DYBKAER might be asked to apply for a prolongation in order to ensure continuity. The vacant place should be filled as soon as possible and it was unanimously decided to nominate Mr. J. C. RIGG (Netherlands) for this vacancy.

13. HERRMANN suggested that it would be worthwhile for IUPAC to produce a dictionary of kinds of quantity in order to achieve easier reference and greater uniformity between different branches of chemistry. The Section on Clinical Chemistry should be asked to endorse a resolution to that effect.

24 August 1973

1. This session constituted a joint meeting of CQUCC with the Expert Panels of the IFCC Committee on Standards on Quantities and Units (EP on QU), on Nomenclature and Principles of Quality Control (EP on NPQC), and on Theory of Reference Values (EP on TRV). Prof. J. BÜTTNER acted as Chairman.

2. A lively discussion was based on the following documents:

EP on NPQC: Synopsis of Proposals (pp. 6) from 1973.7.27

EP on TRV: Document for discussion (pp. 2) received 1973.8.24

R. DYBKAER: Note on Truth, Disturbance, Possibility, Error, Bias, Accuracy, Precision, Observation, and Result (pp. 5) from 1973.8.23

Four terms were examined:

Reference. It was agreed that EP on TRV had most need of this word in the term *Reference value* to replace the ambiguous 'normal value'. EP on NPQC would use other terms for values obtained by reference methods (perhaps 'Reference method value').

Standard. It was generally agreed that this term was overused and should be replaced by 'Comparison material' to be divided into 'Calibration material' and 'Control material'. These should be further described as to composition, state, and origin. A minority (Prof. R. BORTH) preferred to stay with the much used 'standard'.

Accuracy and Precision. The proposal (DYBKAER) to substitute an ordinary statistical description of a 'distribution of disturbance' was not accepted by EP on TRV which thought it too difficult for ordinary users. The majority preferred to define 'inaccuracy' and 'imprecision' to avoid the awkward inverse nature of accuracy and precision. Thus, for these two terms agreement could not be obtained between the majority and Dr. DYBKAER.

25 August 1973

1. This session constituted a joint meeting with representatives from the Commission on Physicochemical Symbols, Terminology, and Units (I.1) (Dr. M. A. PAUL, Prof. A. SCHUIFF, Prof. D. H. WHIFFEN). Drs. PAUL and DYBKAER acted as Co-Chairmen.
2. The discussion followed the items set out in a letter (1973.8.6) from DYBKAER to Commission I.1. It was agreed that the scheme in Table 1-1 was useful. The following remarks were made:
 - 2.1 The term *amount* should be changed to 'extensive kind of quantity' due to the ambiguity of 'amount' in English.
 - 2.2 The word *content* was also ambiguous in English and translated badly into German. This term could not be reserved to mean 'divided by the mass of the system'. A new term might have to be proposed.
 - 2.3 The terms *concentration*, *fraction*, *relative*, *specific*, *molar*, and *rate* were accepted as defined.
 - 2.4 The symbol '. . . . rate' was either (with 'mass rate' as an example) m or dm/dt , whereas 'mean mass rate' with the meaning 'non-differential mass difference per time' was symbolized $\Delta m/\Delta t$.
3. In general, Δ before a kind of quantity symbol was acceptable to indicate differences, but in cases of doubt the algebra should be specified, e.g., products—reactants.
4. It was permissible to prefer θ (lower case theta) over t for Celsius temperature.
5. The term 'elementary entity' was preferred at present, but 'designated elementary entity' was perfectly all right.
6. The term 'dimensionless' was being replaced by 'having the dimension one'.
7. Commission I.1 was not adverse to having CQUCC change the decimal sign in its English documents from a dot on the line to a comma and would consider doing the same at the earliest convenience.
8. Commission I.1 sympathized with the need in clinical chemistry to have a name and symbol for the unit 'unity' and would support a move through proper international channels (ISO, CIPM).
9. Both Commissions were against moves to define and use 'normality' and 'val' because they were covered by 'substance concentration' and 'mole', respectively.
10. Commission I.1 felt that the CBN recommended derived unit *katal* (mol/s) for 'enzymic activity', especially when further derived to katal/l for 'concentration of enzymic activity', led to dimensional trouble. Time did not permit a discussion in depth, but Dr. PAUL would circulate the two relevant pages of the CBN Recommendation 1972 to the Members of Commission I.1 for comment.

COMMISSION ON TEACHING (CTeCC)

24-26 August 1973

Present: Prof. M. RUBIN (Chairman), Prof. P. LOUS (Secretary), Dr. M. ROTH (Titular Members); Prof. A. DEFALQUE (Associate Member); Prof. A. DELEENHEER, Dr. R. S. MELVILLE, Dr. C. J. PORTER, Prof. S. RANGASWAMI, Prof. F. W. SUNDERMAN, Jr. (Observers).

1. The minutes of the previous meeting [Copenhagen, 17 June 1972; see *Inf. Bull.* No. 46 (October 1973), page 15] were approved.

2. A second draft (1972) of the monograph on teaching of clinical chemistry by Prof. RUBIN and a new and shorter chapter on the history of Clinical Chemistry by Dr. ROTH were presented to the Commission. A careful series of comments on the draft and a new formulation of recommendations were presented by Prof. DEFALQUE. A new edition of Chapter 4 had been forwarded by Prof. A. LATNER. Some new and some revised reports had been collected by Prof. LOUS.

3. The whole monograph was scrutinized and many amendments agreed upon. The section on recommendations was reformulated. It was decided that the chapter on history of clinical chemistry should have more emphasis on the development and evolution of concepts. Prof. H. BÜTTNER agreed to formulate a new draft of this chapter. The national reports would be edited by Prof. RUBIN. A table summarizing some important information from the national reports would be worked out by Prof. LOUS. Dr. PORTER would undertake a painstaking linguistic revision of the new draft and Prof. DEFALQUE and Dr. ROTH would collect and review special parts as well as prepare a table of contents. These different activities were planned to be carried out during September and October 1973.

4. The future activities of the Commission were discussed, especially the problems of teaching, education, and training of other personnel than directors and senior staff, which were main topics of the present report. A survey of teaching material, e.g., audio-visual, was contemplated.

5. It was decided to propose as a new Titular Member of the Commission Prof. D. H. CURNOW (Australia) and as new Associate Members Dr. C. J. PORTER (Canada) and Dr. M. SCHWARTZ (USA).

6. The next meeting was scheduled for April 1974 in conjunction with the European Congress of Clinical Chemistry to be held in Munich.

7. On the morning of 25 August a joint meeting of the Commission was held with the Officers of the Committee on Teaching of Chemistry of IUPAC: Prof. R. W. PARRY (Chairman) and Mr. D. G. CHISMAN (Secretary). Prof. RUBIN, in his welcome address, explained the interest of the Commission to exchange information on activities of common interest. A very fruitful discussion centred on the possibilities of clinical chemistry teaching in institutes and departments of chemistry, at higher as well as lower degree of teaching level. Another topic was courses in instrumental analysis. A third topic discussed was 'educational technology', including existing audio-visual teaching materials and other 'teaching aids', in different branches of chemistry. Relations to UNESCO and other bodies interested in teaching were debated.

PHYSICAL CHEMISTRY DIVISION COMMITTEE

21 and 26 August 1973

Present: Dr. G. WADDINGTON (President), Sir HARRY MELVILLE (Past-President), Dr. R. N. JONES (Vice-President), Prof. S. SUNNER (Secretary), Prof. D. H. EVERETT, Prof. E. U. FRANCK, Prof. J. JORDAN, Prof. H. KIENITZ. By invitation: Dr. D. AMBROSE, Prof. M. FAYARD, Prof. G. MILAZZO, Dr. R. PARSONS, Dr. M. A. PAUL, Prof. A. PEREZ-MASIÁ, Prof. N. SHEPPARD.

I. Divisional Activities

The President's Report to Council was accepted. Several matters affecting the work of Commissions and the Division were discussed. There was general agreement that appointments of Associate Members and National Representatives should be for two or four years but limited in some way. The occasional practice of having an individual serve as Titular Member of more than one Commission was not to be recommended, neither was the reelection after two 'off' years of a Member who had previously served eight years. Dr. WADDINGTON was instructed to call these matters to the attention of the Committee on Statutes and Bylaws.

Several matters of finance were noted. Sir HARRY MELVILLE cautioned against Commission-sponsored projects requiring continuing fiscal support when secure funding was not in sight. A plea was made for greater lead time in developing Division budgets, particularly for non-Conference years. In this connection full and early communication was necessary among Commissions, the Division, and the Secretariat. Another matter for the Committee on Statutes and Bylaws was the procedure for electing Members of the Division Committee. Given the need for balanced representation from the Commissions and major geographical areas, the Division had found it difficult to accommodate its procedures to the strict interpretation of the Bylaws. This problem would be studied.

In reviewing the composition of the Division the formation of several new Sub-Commissions was noted. However there was a strong feeling that the field of chemical kinetics, a major area of chemistry, should be represented as a Commission.

Prof. JORDAN initiated discussion of means to improve publicity for Division (and IUPAC) affairs. A Division Newsletter and regular news items in scientific journals were considered. A resolution bearing on this subject was approved for followup.

The current move to coordinate in some way all nomenclature and symbols groups in IUPAC was endorsed in principle. However, it was agreed that the highly specialized area of symbols and units for physical quantities must be centred in the Physical Chemistry Division.

2. Commission Activities

Details of Commission activities were presented under the minutes of the respective Commission meetings already held in Munich. The President noted the excellent progress being made in publication of a series of guidelines for publication of papers in various areas (*e.g.*, thermodynamics and thermochemistry, electrochemistry, and several branches of spectroscopy, and colloid chemistry). These guidelines reinforced the IUPAC recommenda-

tions on symbols and units and enhanced the usefulness of published experimental data. Chairmen or Secretaries of the six Commissions presented to the Division Committee items from their meetings requiring action.

Commission I.1. Approval was requested for a revised edition of the *Manual of Symbols and Terminology for Physicochemical Quantities and Units* to incorporate changes in the new second edition of *Le Système International d'Unités* (English version), changed values of fundamental constants to be released soon by the Committee on Data for Science and Technology (CODATA) of ICSU, and a revised Section 2.8 'Light and Electromagnetic Radiation', prepared jointly with Commission I.5. Funds were requested for special meetings in 1974 and 1975.

Commission I.2. Continued support was requested for the formation, with IUB and IUPAB, of an Inter-Union Commission on Biothermodynamics. It was recommended that the Sub-Commission on Plasma Chemistry (I.2.1) be continued until 1975 but that consideration be given to its conversion to Commission status or to its transfer as a Sub-Commission to a Commission on Chemical Kinetics should it be formed. Sub-Commission I.2.1 requested \$4,000 for meetings in 1974 and 1975 and the preparation of a comprehensive bibliography of its field. An invitation had been received to hold the IV International Conference on Chemical Thermodynamics in France in 1975. The Commission asked for but could not be assured of a modest subvention in support of this meeting. The Division noted the availability of the Thermodynamic Tables Project under Sub-Commission I.2.2, if compensated from outside sources, to provide services to industry in the form of internationally agreed tables of PVT data for natural gas fluids for monitoring large-scale international exchanges.

Commission I.3. The document 'Nomenclature, Symbols, and Units in Electrochemistry' was approved for final publication. Authorization to hold a special meeting in 1974, location to be decided later, was requested. Funding by IUPAC up to \$2,500 was requested. Topics requiring discussion by the Commission included: inhibition in corrosion and electrocrystallization, electrode kinetics, an electrochemical data bank, and nonisothermal electrochemistry.

Commission I.4. Subcommission I.4.1 in continuation of its programme on reference and calibration standards for science and industry had requested from IUPAC \$2,500 in partial support of a meeting to be held at Gdańsk in 1974. It was agreed that provisional publications from this programme would be individual chapters each covering standards for selected groups of properties. It was recommended that these chapters appear as Tentative Nomenclature Appendices to the *Information Bulletin*. The aim was to complete about twelve chapters by March 1974.

Commission I.5. A document 'Recommendations for Presentation of Raman Spectra for Cataloging and Documentation in Permanent Data Collections' was approved for Council action. 'Recommendations for Presentation of NMR Data for Publication in Chemical Journals—B: Conventions Relating to Spectra from Nuclei other than Protons' and 'Recommendations for Nomenclature and Spectral Presentation in Chemical Electron Spectroscopy Resulting from Excitation by Photons' were approved for publication as tentative recommendations. A request was received for IUPAC sponsorship, without funds, of the IV International Conference on Raman Spectroscopy at Brunswick, Maine, in August 1974.

Commission I.6. Approval was given for publication as a tentative recommendation of 'Manual of Definitions, Terminology, and Symbols in Colloid and Surface Chemistry—Part II: Heterogeneous Catalysis'. A related document on nomenclature for zeolites and molecular sieves was well advanced. It was noted, with approval, that the National Physical Laboratory, in part stimulated by the Commission, had prepared for distribution four surface area reference standards.

3. Membership

The candidates presented by the Nominating Committee were endorsed by the Division Committee. The new Members were Prof. A. R. H. COLE (Australia), Prof. M. FAYARD (France), Prof. L. V. GURVICH (USSR), Prof. R. HAASE (Federal Republic of Germany), and Prof. E. F. WESTRUM, Jr. (USA). Officers were elected as designated in the following listing of the current membership: Dr. R. N. JONES (President), Dr. G. WADDINGTON (Past-President), Prof. S. SUNNER (Vice-President), Prof. M. FAYARD (Secretary), Prof. A. R. H. COLE, Prof. D. H. EVERETT, Prof. L. V. GURVICH, Prof. R. HAASE, Prof. H. KIENITZ, and Prof. E. F. WESTRUM, Jr. The retiring Members—Prof. E. U. FRANCK, Prof. J. JORDAN, Sir HARRY MELVILLE, and Prof. M. PRETTRE—were given a sincere vote of thanks for their services.

The results of Commission elections (reported elsewhere in the *Comptes Rendus*) were approved after discussion. The request from the Executive Committee to reduce Titular Membership of all Commissions to eight had been carried out.

COMMISSION ON PHYSICOCHEMICAL SYMBOLS, TERMINOLOGY, AND UNITS (I.1)

22-25 August 1973

Present: Dr. M. A. PAUL (Chairman), Prof. M. FAYARD (Secretary), Dr. D. R. LIDE, Jr., Prof. A. PEREZ-MASIÁ, Dr. A. SCHUIFF, Prof. K. G. WEIL, Prof. D. H. WHIFFEN (Titular Members); Prof. U. STILLE (Observer).

1. Minutes of Previous Meeting

These had been published in *Inf. Bull.* No. 45 (May 1973), pages 48-50.

2. Manual of Symbols and Terminology for Physicochemical Quantities and Units

Consideration was given to minor revision of the 1969 text of the Manual. Because a reprinting of the Manual was needed, the opportunity was being taken to revise the treatment of the International System of Units (SI) to bring the language in accordance with that of the approved translation into English of the second edition (1973) of the document *Le Système International d'Unités*, published by the Bureau International des Poids et Mesures (BIPM). The revisions related mainly to relaxation of the strictures against using with the SI certain units outside the SI that were important and widely used or were recognized as useful in specialized fields. The opportunity was being taken also to update the table of values of fundamental constants included in the Manual, to include a selection from the self-consistent set expected to be recommended shortly by the Committee on Data for Science and Technology (CODATA) of ICSU. Section 2.8 dealing with 'Recommended Names and Symbols for Light and Related Electromagnetic Radiation' and distributed in revised form as Tentative Nomenclature Appendix No. 24 (June 1972) to the *Information Bulletin*, was discussed in joint session with Commission I.5 (Molecular Structure and Spectroscopy). It was approved with minor revisions (inclusion of a footnote relating to internal transmittance measurements for a solution relative to the solvent). Commission I.1 concurred on the text of the revised Manual, for which authorization to publish would be sought from the Physical Chemistry Division Committee and Council.

2. Quantum Chemistry

Consideration was given to a project for standardizing the terminology and symbols used in representing the results of quantum chemical calculations (the so called 'atomic units'). The Commission concurred that the problem centred on the selection of a set of dimensionally independent physical constants, at least four in number, to serve in place of the metre, kilogram, second, and ampere, as intermediary bases in terms of which the theoretical computations could be more appropriately expressed. Such a set of constants might consist of the electron mass (m_e), the elementary charge (e), the Planck constant divided by 2π (\hbar), and the permittivity of vacuum multiplied by 4π ($4\pi\epsilon_0$). It was recognized that the combination of constants representing the Bohr radius (a_0) and that representing the so called Hartree energy ($e^2/4\pi\epsilon_0 a_0$) were also particularly useful for simplifying the representation of quantum chemical calculations, and that the latter needed a generally accepted symbol, not in conflict with symbols for other quantities. Opinions

of the quantum chemical community had been solicited by a notice published in the *Quantum Chemistry Program Exchange Newsletter* and elsewhere, and reception of the idea of an IUPAC-sponsored effort to secure agreement on a minimum set of guidelines for the treatment of Units in theoretical calculations had been generally favoured. The Commission concurred in the drafting of a brief document setting forth the principles outlined above, for dissemination among chemists and physicists, with a call for criticism. It was agreed that IUPAP and the Inter-Union Commission on Spectroscopy should be informed about this project and should be invited to concur in any definitive recommendations developed by IUPAC. The project was discussed during the Munich Conference in joint session with Commission I.5.

3. Joint Meetings

Productive joint meetings were held with Commissions I.2 (Thermodynamics and Thermochemistry), I.3 (Electrochemistry), I.6 (Colloid and Surface Chemistry), III.3 (Organic Photochemistry), V.5 (Electroanalytical Chemistry), and CQUCC (Quantities and Units of Section on Clinical Chemistry), as well as with Commission I.5 (Molecular Structure and Spectroscopy). Among the general conclusions on which there was a consensus was that there is no need for a physical quantity distinguished from 'amount of substance' by the name 'equivalent'; in any event, this quantity as ordinarily defined (by counting some specified submultiple of the number of chemical entities corresponding to the formula assigned to the substance) had the same dimension as 'amount of substance' and called for the same unit in the SI, the mole. For example, one could express the concentration of KMnO_4 or of $1/5 \text{ KMnO}_4$ equally in moles per litre, always specifying which entity (KMnO_4 or $1/5 \text{ KMnO}_4$, respectively) was identified for one's purpose as the substance to which the amount of substance was referred.

Commission I.1 received with interest information on the progress on documents which the Members had previously reviewed and commented upon in preliminary form, prepared by the other Commissions and intended as Appendices to the *Manual of Symbols and Terminology for Physicochemical Quantities and Units* in the specialist fields of Electrochemistry and Heterogeneous Catalysis (the document for the latter field is Part II of 'Definitions, Terminology, and Symbols in Colloid and Surface Chemistry', already published in definitive form by IUPAC as a product of Commission I.6). Useful discussions of symbols and sign conventions in polarography were held with Commission V.5 in connection with that Commission's draft document on terminology and symbols for the field of electroanalytical chemistry which was in preparation for publication in tentative form.

Members of Commission III.3 wished to initiate action on standardization, particularly of symbols and terminology for excited states of molecules, such as were encountered in photochemical research. Members of Commissions I.1 and I.5 discussed jointly with them the nature of the scientific problems involved and procedures for gaining international acceptance of recommendations.

CQUCC (Commission on Quantities and Units in Clinical Chemistry) had published in tentative form a condensed version of Recommendation 1966 on Quantities and Units in Clinical Chemistry of IUPAC and IFCC [Appendices Nos. 20 and 21 (February 1972) to the *Information Bulletin*]. Discussion with Commission I.1 focused on developing systematic and unambiguous nomen-

clature, and units consistent with the SI, for various measures of concentration useful in clinical chemistry, and on criticism of the terminology and units that were utilized in assaying enzyme preparations. The problems were particularly acute because of the need for procedures that could be followed by technicians who were not necessarily skilled in chemical analysis. Commission I.1 looked forward to further discussions with the clinical chemists on clarification of symbols, terminology, and units for this difficult field.

4. Membership

Commission I.1 appreciated and wished to acknowledge the important contributions of Prof. STILLE to the discussions held during the present meetings. Prof. STILLE was a Member of the Symbols, Units, and Nomenclature (SUN) Commission of IUPAP, a Member of the International Committee on Weights and Measures (CIPM), and representative of IUPAP on Technical Committee 12 of the International Organization for Standardization (ISO/TC 12). Commission I.1 welcomed him as a new Associate Member representing IUPAP.

The Commission recommended to the Physical Chemistry Division Committee for transmission to the Executive Committee of IUPAC, the nomination of Prof. M. L. McGLASHAN as Associate Member of the SUN Commission of IUPAP, representing IUPAC, and continuation of his representation of IUPAC on the Advisory Committee of ISO/TC 12.

Prof. V. KELLÖ (Czechoslovakia) was nominated for the term 1973–1977 as a new Titular Member of Commission I.1, succeeding Dr. PAUL. Dr. PAUL was nominated as a new Associate Member, and continuation of Prof. McGLASHAN and Dr. J. TERRIEN as Associate Members was recommended. Prof. WHIFFEN was elected Chairman and Prof. FAYARD was reelected Secretary for the biennium 1973–1975.

COMMISSION ON THERMODYNAMICS AND THERMOCHEMISTRY (I.2)

22–25 August 1973

Present: Prof. S. SUNNER (Chairman), Prof. E. F. WESTRUM, Jr. (Secretary), Dr. J. D. COX, Prof. E. U. FRANCK, Prof. F. D. ROSSINI, Prof. S. SEKI, Prof. B. VODAR (Titular Members); Dr. R. J. IRVING, Dr. H. KEHIAIAN, Prof. M. LAFFITTE, Dr. I. WÄDSÖ (Associate Members); Dr. S. ANGUS, Dr. C. W. BECKETT, Dr. M. A. PAUL, Mr. D. D. WAGMAN, Dr. G. WADDINGTON (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting held during 15–18 July 1971 at Washington, DC (see *Comptes Rendus XXVI Conference*, pages 114–117) were approved.

2. Nomenclature

A summary of the *ad hoc* Committee report was made by Prof. ROSSINI and discussed by the participants. Dr. WADDINGTON mentioned that some further consolidation and coordination of symbols was under discussion within IUPAC. Profs. WESTRUM and VODAR both stressed the importance of *discussion* rather than legislation of rules, the interaction between groups, as well as the recognition of needs as points for concern.

For the use of the editors of the *Bulletin of Thermodynamics and Thermochemistry* and as interim measures, the following state symbols were provisionally adopted:

c	crystalline state
g	gaseous state
liq	liquid state
aliqu	liquid crystalline materials
pc	plastically crystalline materials
vit	vitreous, glassy state
s	solid (mixed crystalline and amorphous phase), e.g., in polymers
fl	fluid (especially for the super critical phase)
soln	solution
am	amorphous
aq	aqueous solution of solute

It was decided to establish a continuing *ad hoc* Committee on symbols, nomenclature, and units under the chairmanship of Dr. COX. In particular, the Committee would examine Appendix I of the Manual (see below) and devise a suitable additional Appendix and interact with other interested groups on this subject.

A joint session was held with Commission I.1. Dr. PAUL indicated that a reprinting with minor revisions of the *Manual of Symbols and Terminology for Physicochemical Quantities and Units* was being undertaken. There was less depreciation of the use of non-IUPAC units than previously.

3. Physicochemical Measurements and Standards

Dr. COX reported on the work of Sub-Commission I.4.1 (Calibration and Test Materials) and indicated that there was a possibility of publication of its compilations as a book under IUPAC-Butterworth auspices. He suggested it would be desirable to have wide dissemination of this endeavour as soon

as possible, but recognized that a four-year cycle for updating would be a useful endeavour. The topics included: density, surface tension, calorimetry, thermal conductivity, distillation column performance, refractive index, polarimetry and saccharimetry, permittivity, potentiometric ionic activities, viscosity, PVT and phase equilibria of single component systems, molecular weight determination, and temperature test materials.

Sub-Commission I.4.1 assured that no gaps occur within its compilations in so far as the scope of interest of Commission I.2 was concerned.

4. Guide for Publication in the Primary Literature

'Guide to Procedures for Publication of Thermodynamic Data' had been published in six journals in the English language, as well as in Japanese, in French, and in Russian. The German translation had been completed and it would hopefully be published soon. A similar endeavour under the auspices of CODATA had been published as *CODATA Bulletin* No. 9: 'Guide for Presentation of Numerical Data Derived from Experiment in the Primary Literature'. Additional supplementary guides were being prepared for various fields (including some of interest to IUPAC).

5. Sub-Commission I.2.1 (Plasma Chemistry)

Dr. BECKETT reported on the Symposium in Kiel (6–10 September 1973) being organized by the Sub-Commission and reviewed the programme and administrative matters concerned with it. The major problem of Sub-Commission I.2.1 was that plasma chemistry involved interdisciplinary interests but none of them were dominant. It was not basically a high temperature matter. The crux of the financial problem was that IUPAC could hardly afford another Commission at this time. He commented that he himself would step down soon; others were capable of carrying on the work of the Sub-Commission.

Dr. BECKETT felt that Commission status should be sought in 1975. He agreed to continue as a Member and Prof. H. SUHR agreed to act as Chairman. Among the projects being undertaken was the preparation of a guide. Prof. VODAR urged consideration of critical needs. He commented that a *Bulletin of Plasma Chemistry* was in preparation by Prof. A. T. BELL (USA). A 'Directory of Plasma Chemistry' had been prepared in August 1972, supplemented in March 1973, and would probably be supplemented again after the Kiel meeting. A bibliography for the period 1856–1970 of 4,000 items had been prepared by Dr. D. J. SPEDDING of Auckland and would (hopefully) be printed by IUPAC. Other proposed meetings of this Sub-Commission were enumerated.

6. Pressure Scale

Dr. BECKETT reported no significant new experimental measurements on pressure scales. Prof. VODAR reported that a 50 kton press was now used in USSR, which had a sliding anvil and no extrusion of the gasket was involved. The use of this device would permit very accurate volume increments of transition to be determined.

7. Inter-Union Commission on Biothermodynamics

Dr. WÄDSON surveyed the situation of the hoped for Inter-Union Commission and stated that among the endeavours which it was desirable to accomplish

were an inventory of the laboratories with interests in biothermodynamics, formulation of equilibrium standard states, conditions for experimental thermodynamic work in biothermochemistry and in biothermophysics, and production of a 'Guide for Presentation of Biothermal Data'. The individuals involved in this work included Drs. EDSAL and JENCKS (IUB), Drs. DATTA and PRIVALOV (IUPAB), and Drs. ARMSTRONG and WÄDSE (IUPAC).

Dr. COX urged that these compilation endeavours be coordinated with those of Sub-Commission I.2.1. Prof. SUNNER commented on inter-Commission nomenclature problems. Prof. VODAR suggested that CODATA action might be considered in this area. Prof. SEKI wondered if polymer (*i.e.*, macromolecular) scientists should be involved in the activities of the proposed Commission.

8. Sub-Commission I.2.2 (Thermodynamic Tables)

Dr. COX reported that this Sub-Commission had held its first meeting during the Munich Conference and heard a report by Dr. S. ANGUS on argon tables already published; ethylene tables in press; and other tables in progress. It was anticipated that the ethylene tables would be ready for distribution by the end of 1973, the carbon dioxide tables some months later, and the tables on methane, oxygen, and nitrogen within a year's time. In summary, five or six volumes should be in print by the 1975 IUPAC Conference. The work of the Sub-Commission had expanded. At the present time the Thermodynamic Tables Project Centre (Imperial College, London) was seeking subscriptions from industrial users and hoped that funding from trusts and foundations could be sought by IUPAC. A promise that type-script tables be made available to industrial sponsors a year in advance was thought to be a considerable inducement.

A draft resolution on CODATA funds which involved the royalty return on tables was in preparation. Prof. SUNNER would urge support for special funds by the Commission, Division, *etc.* Prof. VODAR noted that the cost of quality evaluation was high and he wondered whether or not there was some way of estimating the 'benefit' from such tables. It was noted that Imperial College was an invisible contributor in providing space, computer operation, *etc.*

The thermodynamic tables project was an outstanding example of organized data collection, analysis, and publication on the international scale. It was originated and sponsored by IUPAC, had received the scientific support of some 20 institutes in 8 countries, and had done much to stimulate interest in and furtherance of the aims of IUPAC. It was recognized at the outset that in order to organize, coordinate, and progress the programme of the numerous institutes working on a voluntary basis, would require a small, permanent Centre with a salaried staff. It was now clear that the project as a whole would not be viable without the Project Centre. The finances of the Project Centre had always been precarious. Grants had been made in the past by various countries and organizations and the UK Office of Scientific and Technical Information (OSTI) had provided funds in recent years but the size of its grant had been decreasing.

9. Fluid Mixtures Tables—International Data Series

Dr. KEHIAIAN stressed the need for critically evaluated data and commented on the utility of the *Bulletin for Thermodynamics and Thermochemistry* and on the *Guide* prepared by CODATA for various fields as well as the disci-

plinary guides prepared for the various disciplines. He mentioned that for the preparation of tables under the *International Data Series* (IDS), not only had disciplinary guides been produced but in addition five sub-disciplinary guides had also been devised. Support had been received from TRC at Texas A & M University under Prof. ZWOLINSKI and from the Centre de Recherches de Microcalorimétrie et de Thermochimie of CNRS at Marseille under Prof. LAFFITTE. The major support from June 1971 through December 1972 came from TRC. Authors appeared to be delighted to have an opportunity to submit data. He considered IDS to be essentially a primary publication. One volume of data already compiled was circulated to the Members of the Commission at the meeting. Since January 1973 there had been a strong interest in the metallurgical aspects and several metallurgists had been invited to contribute information to IDS.

The various laboratories involved in metallurgical and data projects included National Physical Laboratories; the work at University of California at Berkeley had been supported through Dr. HULTGREN but his US Atomic Energy Commission support was terminated in 1972. The Metallurgical Institute at Grenoble under Prof. BONNIER, who had been putting out a *Bulletin for Thermodata*, also constituted a community of interest with IDS. Prof. K. L. KOMAREK (University of Vienna) was also interested in participating. It was anticipated that completion of the first IDS issue on alloys would be achieved by 1975.

It was noted that cooperation with the IUPAC Solubility Data Project might be possible, but that there were still questions in resolving the problem of conflict in publication. In answer to questions from Commission Members on the scope of the project, it was mentioned that the following symbolism had been used. *A* stood for binary organic systems, *B* for aqueous-organic systems, *C* for inorganic nonelectrolyte systems, and *D* for binary alloys.

The question was raised by Dr. ANGUS as to how the thermodynamic table project would treat mixtures when the time came to approach this subject? He asked how does one help translators and others? Does one select standard combinations of spherical and polar molecules? He felt that IDS was not competitive in any sense with the endeavours of the Thermodynamic Tables Project Centre and could indeed be of great help.

The question of organic mixtures had not been totally resolved. Prof. LAFFITTE had stated that resources were available for the metallurgical tabulation endeavours.

Prof. VODAR enquired as to whether or not IDS was primary or secondary literature. Dr. KEHIAIAN said that IDS had the characteristics of both a primary and a secondary publication.

10. CODATA Task Group on Key Values of Thermodynamic Data

Mr. WAGMAN presented briefly the results of the deliberations of the Task Group. The final second and third sets of thermodynamic key values were approved by the Commission and the fourth set of tentative values would shortly be ready for circulation to the Membership.

11. Experimental Thermodynamics, Volume II

Prof. VODAR reported on the progress that had been made. All of the chapters

had now been received from the authors and set in print. The preliminary material had been prepared and it was hoped that the completed volume could be made available to the reading public in mid-1974.

12. Bulletin of Thermodynamics and Thermochemistry

The 1973 *Bulletin* (No. 16) would be the largest to date and comprised a total of 680 pages. The indexes of the newer issues of the *Bulletin* were being put on computer tapes, which were searchable by compound, *etc.* The literature continued to increase at a growing rate and the scope of the *Bulletin* had been considerably enhanced in recent years. A greater portion of the mechanical and editorial preparation as well as the indexing was now being done at Marseilles under the direction of Dr. KEHIAIAN.

13. III International Conference on Chemical Thermodynamics

This Conference would be held in Baden-bei-Wien on 3–7 September 1973. The superb organization and excellent programme arranged by Prof. F. KOHLER were augmented by the papers on physicochemical techniques at high temperature arranged by Prof. C. B. ALCOCK. It was expected to be the largest international thermodynamics conference yet sponsored by IUPAC.

14. IV International Conference on Chemical Thermodynamics

The Commission engaged in a detailed discussion of the *modus operandi* of thermodynamics conferences. It wondered whether there should be a task group on the organization of these conferences which would seek to preserve the experience of previous operators and make that experience available to new individuals endeavouring to run the next meeting. Each conference might well include instrumentation and might be expected to feature, to some extent at least, the special interests of the host group. On occasion the conference might be split into symposia with a common denominator. Experimental details and techniques, theoretical framework, survey papers, were all recognized as useful devices and Prof. ROSSINI urged that the multiple approach should be used in each conference. The subjects which were most heavily featured for the 1973 Conference might possibly not be covered for the next four-year period. The 1975 Conference could then be expected to feature other topics in the interim.

There was considerable discussion on the site and timing of the IV Conference. The Commission was determined that it would be held in southern France and that the very kind invitation which had been proffered by three groups (Association Francaise de Calorimetrie et d'Analyse Thermique, associated with Société Francaise des Thermiciens, Groupe de Thermodynamique Experimentale de la Division de Chimie Analytique de la Société Chimique de France; Centre de Recherches de Microcalorimétrie et de Thermochimie du CNRS) would be accepted. It was recognized that although Nice was in many respects an ideal site for the Conference, economic accommodation might not be available during the vacation period of the universities there. Other sites and dates would be considered as soon as the dates and place were settled for the 1975 IUPAC Conference.

15. Reports on Other Thermodynamic Conferences

A report on the Experimental Thermodynamics Conference to be held in early April 1974 at Leeds was made by Dr. IRVING. Several conferences which had been held in 1971 through 1973 by Association Française de Calorimétrie et d'Analyse Thermique, a Section of Société Française des Thermiciens of which Prof. LAFFITTE was the current President, and by Groupe de Thermodynamique Chimique de la Société Chimique de France, under the auspices of the Analytical Chemistry Division, were reported by Prof. LAFITTE. Prof. H. TACHOIRE and Dr. CLÉCHET were very active in the former group (AFCAT), which had sponsored in October 1971 a symposium at Nice on thermodynamics and structure involving many of the computerization aspects. In 1972 a symposium on 'Molecular Complexes and Coordination Compounds' was held at Bordeaux. In May 1973 one on 'Thermodynamics and Analytical Process' was held, and one on inorganic compounds at high temperatures was scheduled. Dr. BOIVINET sponsored a symposium by the AFCAT group in 1972. In June 1972 the French Metallurgical Society held a symposium at Marseille, involving metallurgical problems related to calorimetry as well as thermal analysis. In May 1974 there was scheduled a symposium by Société Française de Thermiciens on Metrology in Thermophysics and Thermodynamics.

Prof. WESTRUM presented a brief summary of the Calorimetry Conferences held during 1972 in Colorado and in Worcester, Massachusetts in July 1973. Prof. SEKI discussed the recent progress of the Japanese Calorimetry Conferences operated by the Society of Calorimetry and Thermal Analysis.

16. Revision and/or Supplementation of Commission Publications

The importance of providing guidance to experimentalists in the area of thermochemistry and thermophysics was so significant a part of the work of this Commission that it was considering the addition of another volume (No. III) to the series *Experimental Thermodynamics*. This volume might conceivably deal with transport properties, particularly under conditions of extreme temperature and pressure as well as under the more usual constraints. In addition, a third volume was under consideration for *Experimental Thermochemistry*. Many of the earlier chapters were now obsolete and many advances had been made in that area. It was quite probable that with revision and supplementation of the type of material already included, a substantial volume might be needed. Similarly, the Commission was examining whether or not the advances in the calorimetric aspects of *Experimental Thermodynamics* would justify the initiation of the preparation for a new volume in that area. Many new endeavours resulting in a miniaturization of calorimeters and in operation under difficult constraints, e.g., high pressures, might make such an extension worthwhile.

17. Heralding Urgent Data Needs

At Prof. SUNNER's suggestion some discussion was held of a mechanism by which high priority thermochemical and thermophysical data items could be identified, their relevance formulated, and called to the attention of potential investigators. It was decided to initiate in a simple practical way a section in *Bulletin of Thermodynamics and Thermochemistry*, regarding high priority items for chemical thermodynamic study. It was planned that a committee

should ultimately be established to explore further avenues of more highly organized Commission action in this matter.

18. Frederick D. Rossini Lecture

Prof. ROSSINI had served continuously on the Commission and its predecessors since 1934 except during the war years when there was no IUPAC activity. He had thus surpassed Prof. W. SWIETOSLAWSKI in years of Membership. Out of a number of suggestions of a gracious and appropriate way to honour Prof. ROSSINI, it was decided to institute an F. D. Rossini Lecture to be held every two years at the International Conference on Thermodynamics, initiated by the Commission and hopefully through the years sponsored by IUPAC. Desirably the lecture might be given in 1975 by Prof. ROSSINI himself.

19. Joint Meeting with Commission I.4

Commission I.4 sought the help of Commission I.2 in testing secondary standards for temperature. The sources of standard and recommended samples were desiderata; integrity of the samples precluded commercial distribution.

20. Key Values for Fluids

Some discussion was held concerning a scheme of Prof. G. DE MARIA to secure adoption of key values for physical properties of the fluid state (*e.g.*, at 25°C and 1 atm.)

21. Membership

It was decided to request reappointment of Dr. Cox, Prof. GURVICH, and Prof. WESTRUM for a second four-year period of Titular Membership. Advancement to Titular Membership would be sought for Dr. BECKETT, Prof. LAFFITTE, and Dr. WÄDSÖ. The Associate Memberships of Dr. HEYDEMANN, Dr. IRVING, Dr. KEHIAIN, and Prof. VÎLCU, were now to be considered terminated. Nominations for new Associate Members were agreed in respect of Dr. S. ANGUS (UK), Prof. L. BREWER (USA), Prof. E. HÁLA (Czechoslovakia), Prof. F. KOHLER (Austria), Prof. G. M. SCHNEIDER (Federal Republic of Germany), Prof. Y. TAKAHASHI (Japan), Dr. E. WHALLEY (Canada). Prof. WESTRUM was elected to chair the Commission with Prof. LAFFITTE as Secretary.

SUB-COMMISSION ON THERMODYNAMIC TABLES (I.2.2)

25 August 1973

Present: Dr. J. D. COX (Chairman), Dr. S. ANGUS, Prof. H. D. BAEHR, Mr. F. DENNERY, Dr. H. J. WHITE, Jr.

1. Chairman's Introduction

Dr. Cox pointed out that, although this was the first meeting of the Sub-Commission, the seeds for its development within IUPAC were sewn 10 years ago when the Thermodynamic Tables Project was started, largely as a result of Prof. D. M. NEWITT's efforts. He suggested that some thought be given to the detailed objectives of the Sub-Commission, because none had been provided by the parent Commission I.2 nor by other IUPAC bodies. It was suggested that for present purposes, Sub-Commission I.2.2 would be concerned with all activities developing thermodynamic tables within the context of IUPAC's activities.

Because of the scheduling of the IUPAC Conference in Munich, Drs. COX and ANGUS had already represented I.2.2 in prior meetings. They had reported to I.2 on activities of the Thermodynamic Tables Project Centre in the previous year, had discussed symbols at a joint meeting of I.1 (Physico-chemical Symbols, Terminology, and Units) and I.2 and had also met with I.4.1 (Calibration and Test Materials) to discuss needs with respect to the development of tables.

2. Report on Present Status of Thermodynamic Tables Project

The document, 'A Review of the Work of the IUPAC Tables Project' by Dr. ANGUS (identified as PC/R/28 of February 1973), contained the bulk of this report and had been made available to Members of I.2.2. Dr. ANGUS gave an updating of the status of the activities on various fluids, as follows:

- (i) Argon — published 1972.
- (ii) N₂ — intercomparisons of tables to be done by STEWART.
- (iii) O₂ — intercomparisons of tables to be done by STEWART.
- (iv) Air — measurements at the PTB had been finished but not published. They compared well with BENDER's equation. The Russian group would compare BENDER's work with that of SPIRIDONOV.
- (v) C₂H₄ — proofs had been returned to the printer and publication should be completed before the end of 1973 or early in 1974. Mr. DENNERY raised the question of whether the fluid should be called 'ethene' rather than 'ethylene.' It was recommended that both names be used, and that similar considerations be applied to propylene.
- (vi) CH₄ — tables were being developed in London using BENDER's equation and scaling-law techniques for the critical region. New measurements from Boulder had been included.
- (vii) C₂H₆ — the data now allowed good tables to be developed. EUBANK was writing a report.

- (viii) C_3H_8 — there was a new evaluator in Czechoslovakia.
- (ix) C_3H_6 — no change of status.
- (x) NH_3 — new measurements had been made by BAEHR and had been sent to HAAR. BAEHR would use an equation with 50 coefficients, which had already been used successfully for H_2O , on NH_3 .
- (xi) CO_2 — the final text was being typed. It used the tables of ALTUNIN and GADETSKII. Recently, some other equations had been received.
- (xii) Halogenated hydrocarbons — no change of status. ICI-Mond had some interest in starting work, and there was a substantial amount of recently published Russian work.
- (xiii) Inert gases — no change of status.
- (xiv) Quantum fluids
 - He — MCCARTY had completed revision of his tables. These would be used by the Tables Centre and would form the next report.
 - H_2 — no change in status.

In addition, it could be reported that Dr. ANGUS has been appointed to Sub-Commission I.4.1 (Calibration and Test Materials) and that three portions of the Russian 7-year bibliography had been translated. These were the sections on alcohols (by BP), the section on mixtures (by H. KEHIAIAN) and the section on freons (by Allied Chemical Co.).

3. Policy Questions in Relation to Work of Thermodynamic Tables Project Centre, 1973-75

3.1. *Future programmes.* A fluid of importance which had been missing from the Centre's programme was CO. Prior to the present, the experimental data were inadequate to allow correlation. The holes had recently been filled by new data taken by BABB and tables were now possible. It was, therefore, necessary to consider who could serve on a panel for CO.

Some correlation work was being carried out on aromatic hydrocarbons at NPL under AMBROSE. Benzene was being done and toluene and xylene would follow. Again, it might be desirable to set up a panel.

Experimental work (orthobaric densities) on alcohols was being planned by NPL. Methanol and ethanol could probably be evaluated now. Dr. Cox suggested waiting until the NPL data were available.

The question of whether it was desirable to have a panel to consider methods of correlation was raised. It was the consensus of the Members that such a panel would be desirable. Dr. BAEHR pointed out that there had been a number of advances in evaluation techniques. Dr. WHITE pointed out that computer formulations were desired by US industry.

3.2. *Staff and Financial Needs.* These were outlined in the report 'Financing of the Project Centre' (identified as PC/SC/1 dated February 1973). Shell Research should be added to the list of Industrial Sponsor Subscriptions. In spite of this increase, the situation was very serious. For the year 1973-74 (the Centre's fiscal year begins 1 September) the Centre was facing a deficit of £8,000. Furthermore, Dr. Cox emphasized that this deficit was a minimum because it did not take account of some items (Notes 1, 2, and 3 of PC/SC/1, especially the staffing need mentioned in Note 3).

3.3. *New Sources of Funds.* New sources of funds were obviously needed. Two possible sources within IUPAC were mentioned. The first involved the initiative on IUPAC's part to obtain funding from trusts for special international projects. The second source would be royalties from books published by the Project Centre. The latter would be small at the present time but might be expected to increase as more volumes appeared. It was agreed that both of these sources should be investigated and the Sub-Commission recommended that Dr. Cox should raise the question with I.2 in the joint meeting between I.2.2 and I.2. A resolution to the effect that the Centre be supported by IUPAC from the 'Special Projects' fund and from royalties was drafted for forwarding via I.2 to the relevant IUPAC authorities. Each Member of I.2.2 was requested to send names of companies which might be prospective supporters of the Project Centre to Dr. ANGUS.

3.4. *Natural Gas.* Dr. ANGUS had written a letter to Dr. R. W. CAIRNS, former Deputy Assistant Secretary for Science and Technology of the US Department of Commerce, pointing out that the proposed purchase of liquefied natural gas (lng) by USA from USSR would require an agreement on the properties of lng as a basis for determining the quantities involved. He further pointed out that the Project Centre was uniquely constituted to develop an appropriate formulation for the properties of lng, which would be free from any question of bias towards self-interest of either country. No reply had been received at the time of the meeting.

4. Consideration of Possible Future Activities in Field of Thermodynamic Tables

4.1. *Proposal of Prof. D. M. Newitt.* This proposal called for the establishment of an International Institute of Thermodynamics under UNISIST, suggested that provision of data of high reliability be one of its functions, and further suggested that the Project Centre become part of this International Institute. Copies of the proposal had been circulated. Because I.2.2 had no direct interaction with UNISIST, the proposal was circulated to its Members for information only. It was obvious that financial assistance from UNISIST would be most helpful. No specific actions were initiated by I.2.2.

4.2. *Proposal of Mr. F. Dennerly.* This proposal was concerned with the orientation of future studies with respect to the chemical species involved, the states involved, and the types of properties to be included. It might be noted that mixtures were included, along with simple gases, and transport properties were included along with thermodynamic properties. Copies of the proposal had been circulated. This proposal was handed out at the meeting and, because of its comprehensive scope and nature, it was not possible to react to it at the meeting. It would be discussed at the next meeting after Members of I.2.2 had had a chance to consider it. It was suggested that the plan presented in the proposal could be used to develop a priority list for action and Mr. DENNERLY was asked to make such a list for future consideration.

4.3. *Production of a List of Extant Projects.* The desirability of preparing a list of relevant projects in the field was discussed. It was pointed out that, to some extent, such a listing would overlap with the CODATA 'International Compendium of Numerical Data Projects'. Dr. Cox would write to CODATA to determine what was now in the CODATA file and would encourage them to carry on further with their activities in this area.

5. Membership

5.1. *Possible Additional Members.* Dr. H. KEHIAIAN was suggested as a possible new Member of I.2.2. It was agreed that he would be a valuable contributor to I.2.2 and Dr. Cox was asked to propose this step to I.2 at the joint meeting of I.2 and I.2.2. There was some discussion of the optimum size of I.2.2. It was pointed out that the nature of the Membership would be conditioned by the scope of the activities of I.2.2. No suggestions for further possible Members were made.

5.2. *Appointment of Secretary.* Dr. WHITE was asked to serve as Secretary and agreed to do so.

5.3. *Appointment of Correspondents.* The concept of having correspondents to assist I.2.2 in its duties by providing expertise in certain limited areas without being concerned with all areas of concern was discussed. The concept was outlined in the paper 'Sub-Commission Membership' (identified as PC/SC/3), which had been sent to the Members of I.2.2. It was stated that the concept violated no IUPAC Statutes. The Members felt that the concept might provide useful assistance and recommended that it be discussed with I.2.

5.4. *International Association on Properties of Steam Meeting.* It was recommended that this matter be brought up with I.2 and not be discussed at this meeting.

COMMISSION ON ELECTROCHEMISTRY (I.3)

22-24 August 1973

Present: Prof. R. HAASE (Chairman), Dr. R. PARSONS (Vice-Chairman), Prof. G. MILAZZO (Secretary), Dr. I. EPELBOIN, Prof. A. SANFELD, Dr. R. TAMAMUSHI, Prof. E. YEAGER (Titular Members); Dr. J. C. JUSTICE, Prof. D. MOHLNER (Associate Members); Prof. S. MINČ, Prof. J. W. TOMLINSON (National Representatives).

1. The minutes of the previous meeting (Washington, DC: 15-18 July 1971) had been published in *Comptes Rendus XXVI Conference* (pages 120-122).

2. Dr. TAMAMUSHI presented a printed report on the compilation of electrode kinetics data and a supplement to it. These constituted the continuation of the first part of his collection of data on electrode kinetics in the same spirit and style as that already published in *Electrochimica Acta*. The Commission discussed the possibility of storing the data on the computer, and Dr. TAMAMUSHI communicated the steps that were being undertaken in his country to solve the problem of efficient storage and retrieval of data. This point was important in view of the general problem of the bank for electrochemical data. Dr. TAMAMUSHI was invited to contact the relevant IUPAC authorities about publication of this report.

3. Prof. MILAZZO presented the tables compiled by he and his coworkers on electrode potential data in the final form adopted after the discussion, comments, and criticisms obtained within the framework of the Commission as well as by colleagues outside the Commission. After a short introduction by Prof. MILAZZO and a short discussion, considering the amount of material, cost involved, and necessary time for publication, it was resolved that Prof. MILAZZO should arrange for publication outside IUPAC with an appropriate acknowledgement for the work done within the Commission.

4. The work on compilation of electrode potential data in fused salts by Prof. PLAMBECK was adopted by the Commission as one of its activities. Because it had never been discussed at previous meetings of the Commission it was decided that, also in this case, Prof. PLAMBECK should arrange for publication outside IUPAC with appropriate statement of the circumstance that discussions thereon were made only with Members of the Commission.

For all these reports it was resolved to wait for the results obtained by Dr. TAMAMUSHI concerning the storage of data in order to decide whether and in what form to consider the storage of the data collected by MILAZZO and coworkers and by TAMAMUSHI. Prof. SANFELD was also charged to contact Prof. PLAMBECK for an eventual different solution of this problem.

It was then decided to contact also official bodies of countries from which it was difficult to obtain data in order to see how the situation could be improved.

5. Prof. EPELBOIN rapidly summarized the situation after the Washington meeting in order to decide whether to resume and to continue the work in the area of corrosion and inhibitors. It was decided that the theme was really worthwhile to be considered among the activities of the Commission. The preparation of the activity in this area was then deferred to the next meeting, in the meantime asking qualified specialists for help.

6. Prof. SANFELD gave his report based on an enquiry with several qualified specialists concerning the recommendations presented by Prof. EPELBOIN at the Washington meeting to authors of papers dealing with electrochemical kinetics. The discussion was extended to recommendations to authors of electrochemical papers in general to give, as far as possible, the first-hand crude results of their experiments before any theoretical processing in order to store them (in the bank of electrochemical data or elsewhere) for eventual future reuse in the light of new theoretical knowledge.

7. A discussion was started on the opportunity to hold a meeting of the Commission in 1974. The arguments considered were such as really demanded an interim meeting to discuss deeply the problems and to prepare conveniently the work of the Commission for the 1975 meeting. The themes considered were:

- (i) inhibition in corrosion and electrocrystallization,
- (ii) electrode kinetics,
- (iii) bank for storage of electrochemical data,
- (iv) nonisothermal electrochemistry.

It was decided to ask the Physical Chemistry Division Committee to approve and support financially this interim meeting. Time and place could be decided later in order not to interfere with the 1974 ISE meeting. In order to keep the expenses at a minimum the Secretary was charged, in the event that the Division approved in principle this request, to ask each Titular Member whether he could cover his travel and subsistence expenses by other means, so that the financial burden to IUPAC could be diminished.

8. The tentative Appendix to the *Manual of Symbols and Terminology for Physicochemical Quantities and Units* on the nomenclature, symbols, and units concerning Electrochemistry, was finalized after intensive discussions, taking into account and incorporating, whenever possible, comments expressed by Commissions I.1, I.6, and V.5 (during three separate joint meetings) as well as by a number of qualified electrochemists throughout the world. The final typewritten version would be delivered to the Secretariat in the shortest possible time to ensure early publication in *Pure and Applied Chemistry*.

9. Regarding future Membership of the Commission, the Titular Memberships of Prof. SANFELD and Dr. TAMAMUSHI were extended for four and two more years, respectively.

COMMISSION ON PHYSICOCHEMICAL MEASUREMENTS AND STANDARDS (I.4)

22–25 August 1973

Present: Prof. H. KIENITZ (Chairman), Dr. D. AMBROSE (Vice-Chairman and Secretary), Dr. I. BROWN, Dr. J. P. CALI, Dr. J. FRANC, Dr. R. P. GRAHAM, Dr. Y. MASHIKO (Titular Members); Dr. A. JUHASZ, Dr. L. A. K. STAVELEY (Associate Members); Prof. H. FEUERBERG, Dr. T. PLEBANSKI (National Representatives); Dr. E. BRUNNER, Dr. G. GIRARD (Observers).

1. The minutes of the previous meeting (Washington, DC; 15–18 July 1971) had been published in *Comptes Rendus XXVI Conference* (pages 123–125).

2. The Commission made the following elections:

- (i) *Titular Members.* Dr. D. AMBROSE elected as Chairman, Dr. J. P. CALI elected as Vice-Chairman and Secretary, Dr. E. BRUNNER, Dr. J. E. LANE, Dr. T. PLEBANSKI, Dr. J. TERRIEN elected for 1973–1977.
- (ii) *Associate Members.* Dr. I. BROWN, Prof. H. FEUERBERG, Prof. H. KIENITZ, Prof. G. MILAZZO elected.
- (iii) *National Representatives.* In consequence of a nomination by the Czechoslovak Academy of Sciences, Dr. M. MATRKA was accepted as a National Representative. The Commission hoped Prof. W. THOMAS and Mr. A. NEWTON would be invited to serve as National Representatives of, respectively, Federal Republic of Germany and UK.

3. The Physical Property Task Group had met in Zeist in 1972, and a report of the meeting appeared in *Information Bulletin* No. 44 (December 1972), pages 37–40. In accordance with the decision taken at the XXVI IUPAC Conference, this Task Group had now been reconstituted as Sub-Commission I.4.1 on Calibration and Test Materials.

4. Dr. CALI reported that NBS was prepared to publish the Proceedings of the Ottawa Purity Symposium of 1961, without cost to IUPAC, as a joint IUPAC-NBS publication if a request was made by IUPAC for publication in that way. Because it had appeared probable that publication would not be possible otherwise and that there would be no record available of this valuable work, the Commission agreed that, if this could be arranged, it would resolve the problem satisfactorily and was greatly to be welcomed.

5. Dr. AMBROSE reported that the two papers on the vapour pressure of water discussed at the XXVI IUPAC Conference, *viz.* that by WEXLER and GREENSPAN and that by AMBROSE and LAWRENSON, had been published and that it would be possible to produce detailed tables based on IPTS-68, similar to those currently available in Steam Tables based on IPTS-48, that were agreed by both pairs of authors. There was a small doubt about the exact value to be adopted for the vapour pressure at the triple point, but for many purposes this uncertainty was not significant. Work was in progress at NBS which, it was expected, would provide a value of high accuracy for this property. The Commission recommended that detailed tables should be prepared for publication as soon as practicable.

6. Dr. GIRARD presented a report on the density of water and work relating to it in progress at BIPM, and this was discussed by Dr. BROWN with reference to the chapter on density being prepared for Sub-Commission I.4.1.

The work on which any tables of density of water must be based antedates the establishment of the International Practical Temperature Scale, and it was not immediately obvious to a reader of the original papers which temperature scale was used by the authors. This obscurity had been clarified and it was now possible to produce a new table of density over the range 0°C to 40°C that represented the best interpretation possible of the data. Some existing tables were expressed in relative terms, but it was intended that absolute values should now be calculated based on the value of the maximum density of Standard Mean Ocean Water (SMOW) recommended by BIPM. However, the new table would not have the accuracy attainable in modern metrological measurements and, in view of the importance of this property of water, it was desirable that new determinations of the maximum density, thermal expansion, and effect of dissolved gases should be made. Current work at NBS on the density of specially prepared silicon boules would provide a new absolute standard in this field, which should be the basis for any further work on the density of water. The Commission decided to prepare a case, for submission through the Division Committee to national standards laboratories throughout the world, advocating establishment of a cooperative programme on determination of the density of water in the range of 0°C to 40°C.

7. Dr. GRAHAM reported that the Committee on Standardization of the International Confederation for Thermal Analysis (ICTA), in continuation of work reported at the XXVI IUPAC Conference, was organizing international test programmes to examine a further series of potential DTA temperature standards for the region below 100°C and to examine the glass transition in a polystyrene film sample as a potential temperature standard for this phenomenon. The Committee was also studying other phenomena that might be of importance in thermal analysis.

8. In discussion of the *Catalog of Physicochemical Standard Substances* [Pure Appl. Chem. 29, 597 (1972)], Prof. FEUERBERG reported on the types of standard reference material available from BAM and PTB, and Drs. CALI and AMBROSE summarized the positions at NBS and NPL, respectively. The Commission decided that the Catalog and the work of Sub-Commission I.4.1 were complementary and that it was timely for the Catalog to be revised. Dr. CALI undertook responsibility for collecting the necessary information, and it was agreed that, because the changes planned would not be in the format but only in the entries under each heading, a request should be made that publication of a revised edition be authorized without delay attendant upon preliminary circulation as a Tentative Nomenclature Appendix to the *Information Bulletin*.

9. The importance of correct and consistent use of the terms 'accuracy' and 'precision' was discussed, and Dr. MASHIKO undertook to prepare a paper on this subject for the Commission with particular reference to physicochemical measurements.

10. At the XXVI IUPAC Conference, the Commission recommended discussion at a future meeting of pressure fixed points and methods for vapour-pressure measurements. The first of these subjects was adopted into the programme of Sub-Commission I.4.1 as an item on pressure measurement. With respect to the second, Dr. AMBROSE undertook to prepare a paper on vapour-pressure measurements so that the Commission might consider whether it was possible to make recommendations on the methods to be used in different ranges, and the accuracies to be expected.

11. A joint meeting with Commission I.2 was held at which matters of mutual interest were explored. One point discussed was the desirability of securing as wide a dissemination as possible of any recommendations, because it appeared that *Pure and Applied Chemistry* did not reach many of those to whom thermodynamic and physical properties were of importance.

12. It was agreed that a meeting during 1974 of Sub-Commission I.4.1 would expedite its work and the Chairman would apply for a subvention from IUPAC funds for this purpose.

SUB-COMMISSION ON CALIBRATION AND TEST MATERIALS (I.4.1)

22-25 August 1973

Present: Prof. H. KIENITZ (Chairman), Dr. D. AMBROSE, Dr. S. ANGUS, Dr. I. BROWN, Dr. E. BRUNNER, Dr. J. P. CALI, Dr. J. D. COX, Prof. H. FEUERBERG, Dr. J. FRANC, Dr. Y. MASHIKO, Prof. G. MILAZZO, Dr. T. PLEBANSKI, Dr. H. ZIEBLAND.

1. The Sub-Commission, which was constituted in 1972 from the former Physical Property Task Group, had before it draft chapters of its recommendations. These had been circulated in advance, and many comments had been received by the authors. It was agreed that the separate chapters should be offered, as they become available, for publication as Tentative Nomenclature Appendices to the *Information Bulletin*, the first instalment to be accompanied by the introductory chapter. An offer by Dr. E. F. G. HERINGTON (formerly a member of Commission I.4) to act as editor was accepted, and it was agreed to ask for secretarial support for the editor by the IUPAC Secretariat and payment from IUPAC funds of his necessary expenses.

2. It was agreed to adopt a threefold classification for the different types of reference material, viz. (i) primary substances, (ii) certified reference materials, and (iii) calibration and test reference materials. It was also agreed that the terms 'accuracy' and 'precision' should be defined in the introductory chapter along lines proposed by Dr. MASHIKO, and used consistently throughout the recommendations, and that the importance of the traceability of measurements to national standards should be emphasized.

3. The chapter on calorimetric properties (team leader: Dr. COX) was ready, subject to editorial amendment, for publication and it was hoped the introductory chapter (Dr. CALI) would be ready by the end of the year. The following chapters required revision, which, it was hoped, would be complete by March 1974: density (Dr. BROWN), surface tension (Dr. BROWN), PVT (Dr. AMBROSE), thermal conductivity (Dr. ZIEBLAND, in succession to Dr. BRUNNER), vapour-liquid phase equilibria (distillation column performance) (Dr. BRUNNER), refractive index (Dr. BROWN), optical rotation (Dr. BROWN), optical transmittance, wavelength and reflectance (Prof. MILAZZO, in succession to Prof. FEUERBERG), permittivity (Prof. KIENITZ), and potentiometric ion activities (Dr. CALI). It was also hoped that first drafts of the following chapters, which were either newly undertaken or in which no progress had so far been made, would be presented: temperature (Dr. KIENITZ, who would seek assistance from Commission I.2), pressure (Dr. BRUNNER), viscosity (Dr. PLEBANSKI), electrical conductivity (Dr. JUHASZ), and vapour-liquid phase equilibria (aqueous salt solutions) (Dr. PLEBANSKI). No progress had been made on molecular weight, and a team leader for this chapter had still to be found.

4. The following general points arose in discussion:

- (i) Because revision of the *Catalog of Physicochemical Standard Substances* was planned, reference would be made to this where appropriate.
- (ii) The units and nomenclature used must be in accord with IUPAC recommendations, in particular with the *Manual of Symbols and Terminology for Physicochemical Quantities and Units*.
- (iii) Commission I.2 would be kept informed of the progress of the work.

COMMISSION ON MOLECULAR STRUCTURE AND SPECTROSCOPY (I.5)

23–25 August 1973

Present: Prof. N. SHEPPARD (Chairman), Prof. A. R. H. COLE (Vice-Chairman), Prof. F. A. MILLER (Secretary), Dr. J. H. BEYNON, Prof. M. A. ELYASH-ÉVICH, Prof. E. FLUCK, Prof. A. HADNI, Prof. Y. MORINO (Titular Members); Prof. B. JEŻOWSKA-TRZEBIATOWSKI, Prof. S. NAGAKURA, Prof. C. N. R. RAO, Prof. Sir HAROLD THOMPSON, Dr. D. W. TURNER (Associate Members); Dr. K. FREI, Dr. R. N. JONES, Prof. M. L. JOSIEN, Dr. D. R. LIDE, Jr., Prof. E. ROTH, Prof. T. SHIMANOUCI, Prof. G. ZERBI (Sub-Commission Members).

1. An informal meeting of the Commission [see *Inf. Bull.* No. 45 (May 1973), pages 33–36] had been held at Wrocław on 17 September 1972.

2. A document on 'Recommendations for Presentation of Raman Spectra for Cataloging and Documentation in Permanent Data Collections' awaited final Council approval. It had been published in February 1971 as Tentative Nomenclature Appendix No. 11 to the *Information Bulletin*, was revised after the eight months waiting period, and had been approved by the Physical Chemistry Division.

3. Commission I.5 joined Commission I.1 in recommending that a revised version of the *Manual of Symbols and Terminology for Physicochemical Quantities and Units* be prepared. The two Commissions had agreed on several changes that should be made, having to do mainly with definitions of: (i) transmittance of solutions, (ii) absorbance and absorption coefficient, and (iii) complex refractive index. Some of these were included in Tentative Nomenclature Appendix No. 24 (June 1972) to the *Information Bulletin*.

4. The Commission recommended IUPAC sponsorship of the IV International Conference on Raman Spectroscopy which would be held at Brunswick, Maine, in August 1974. No funds were requested.

5. The Commission supported the proposal concerning data flagging from the Analytical Chemistry Division. However, it did have considerable concern about some of the abbreviations that had been suggested for spectroscopic data, and requested the opportunity of being consulted on this point.

6. A document on 'Recommendations for Presentation of NMR Data for Publication in Chemical Journals—B: Conventions Relating to Spectra from Nuclei other than Protons' was accepted after careful consideration and some revision. It supplemented an earlier Part A which dealt with protons [*Pure Appl. Chem.* **29**, 625 (1972)]. It was urged that Part B be published as a tentative recommendation.

7. Tentative 'Recommendations for Nomenclature and Spectral Presentation in Chemical Electron Spectroscopy Resulting from Excitation by Photons' were received, revised at the meeting, and accepted by the Commission. Publication was recommended.

8. 'Nomenclature and Conventions for Reporting Mössbauer Spectroscopic Data' was published in August 1973 as Tentative Nomenclature Appendix No. 33 to the *Information Bulletin*. It would be put into final form after the standard eight-month period for receipt of comments.

9. It was decided to revise Parts I and II of *Tables of Wavenumbers for Calibration of Infrared Spectrometers* and to publish these together with the

more recent Parts III and IV in a hard-back volume. The revision of Parts I and II did not appear to be extensive and was expected to be completed in about nine months.

10. The project on 'Specification of Infrared Spectra for Documentation Purposes' had been held up so that specifications for Fourier transform spectra could be incorporated. A verbal report on progress was heard.

11. A preliminary report on 'Definitions and Symbolism for Force Constants' was received and discussed at length. This project would be pursued actively, for considerable need for standardization had been expressed.

12. There were tentative plans to organize a session on 'Data Handling in Spectroscopy', with the cooperation of the Commission, for the CODATA meeting to be held at Erevan, USSR, in June 1974.

13. Commission I.5 had no comment on the proposal for a new Commission on Physical Organic Chemistry. If the Commission was set up, however, there would be areas of mutual interest and it was hoped to have close collaboration on them.

14. The next formal meeting of the full Commission would be in 1975 in conjunction with the XXVIII IUPAC Conference (1975).

15. The composition of the Commission was considered and the following recommendations were made:

- (i) *Titular Members.* Prof. ELYASHÉVICH was chosen to be Vice-Chairman, and Prof. HADNI was elected to a second four-year term. Dr. E. D. BECKER (USA) and Prof. G. ZERBI (Italy) were nominated as new Titular Members.
- (ii) *Associate Member.* Prof. MORINO (Japan) was nominated.
- (iii) *Sub-Commission I.5.1.* Prof. J. R. DURIG (USA) and Prof. C. J. H. SCHUTTE (Republic of South Africa) were nominated as new Members.
- (iv) *Sub-Commission I.5.2.* Dr. R. N. JONES (Canada) and Dr. R. S. MACDONALD (USA) were nominated as new Members.
- (v) *Sub-Commission I.5.3.* Newly-nominated for membership were Dr. J. ČERMÁK (Czechoslovakia), Dr. F. P. LOSSING (Canada), and Prof. A. TATEMATSU (Japan).

COMMISSION ON COLLOID AND SURFACE CHEMISTRY (I.6)

23–26 August 1973

Present: Prof. D. H. EVERETT (Chairman), Prof. S. BRUNAUER (Vice-Chairman), Prof. H. VAN OLPHEN (Secretary), Prof. R. L. BURWELL, Jr., Prof. R. HAUL, Prof. C. KEMBALL, Dr. K. J. MYSELS, Prof. G. SCHAY (Titular Members); Prof. R. M. BARRER, Prof. A. SCHELUDKO (Associate Members); Prof. V. RAMAKRISHNA (Observer).

Joint sessions were held with Commission II.2 (Nomenclature of Inorganic Chemistry), with Commission I.3 (Electrochemistry), and with Commission I.1 (Physicochemical Symbols, Terminology, and Units).

I. Minutes of Previous Meeting

The minutes of the Commission meeting at Washington, DC, on 15–18 July 1971 (see *Comptes Rendus XXVI Conference*, pages 129–130) were approved.

2. Terminology, Symbols, and Units

- (i) Part I of the 'Manual of Symbols and Terminology for Colloid and Surface Chemistry', which was accepted for final publication at the Council meeting in Washington, DC (1971), had appeared in *Pure and Applied Chemistry* [31, 577 (1972)]. The Secretary attended an interim meeting of Commission I.1, held in Paris, 18–19 October 1972. When presenting the most recent draft of Part II on 'Heterogeneous Catalysis', several of the many new Members of Commission I.1 noted the difference in style between the main *Manual of Symbols and Terminology for Physicochemical Quantities and Units* (the Green Book), which only contained terms and symbols without descriptive definitions, and Part I which contained definitions of all terms in full text. They felt that the projected extension of the Green Book to include Parts I and II and other subdisciplines of physical chemistry as Appendices would become quite voluminous, and hence costly to translate into other languages. It was suggested to drop Parts I and II as Appendices. However, the Commission was persuaded not to reverse the previous decisions, but it was suggested that the Green Book might contain only the 'List of Symbols and Abbreviations' of Parts I and II with proper reference to the full documents as published by IUPAC. It was noted, however, that Appendix I (Definition of Activities and Related Quantities), which was already included in the Green Book, constituted a departure in style from the main Manual because it contained descriptive definitions of terms, and policy on the scope of the Green Book might still change in the course of time.
- (ii) Prof. BURWELL's Project Group on Nomenclature for Heterogeneous Catalysis (Part II) had met during a few days prior to the V International Congress of Catalysis in Palm Beach, August 1972, to discuss and revise an earlier draft of the material [see *Inf. Bull.* No. 44 (December 1972), page 55]. Comments were subsequently solicited from Members of Commissions I.6 and I.1. These comments were discussed at the present meeting and the draft was finalized. Before presenting the final draft to the Physical Chemistry Division Committee for approval, it was reviewed and slightly modified in a joint session with Commission I.1.

- (iii) The Commission discussed the desirability of revising and expanding Sections 1.11 (Electrochemistry) and 1.12 (Electrokinetics) of Part I in the light of proposals from Commission I.3 contained in Tentative Nomenclature Appendix No. 28 to the *Information Bulletin*, 'Electrochemical Definitions and Symbols', which had appeared in November 1972. Commission I.6 met subsequently with Commission I.3 to discuss this matter as well as the division of responsibilities of the respective Commissions. Dr. PARSONS (I.3) mentioned that comments received on the proposals in TNA No. 28 and particularly consultation with Commissions I.1 and V.5 (Commission on Electroanalytical Chemistry) necessitated a fair amount of rewriting. However, Section 5 which was most relevant to Sections 1.11 and 1.12 of Part I, would not be changed in substance. (Dr. PARSONS noted that U had been abandoned in favour of E). Prof. EVERETT related a few more or less minor comments from Commission I.6 on Section 5 as follows:

Re 5.3—In 1.11 the abbreviations p.z.c. stood for 'point of zero charge' rather than potential of zero charge, emphasizing that p.z.c. referred to a condition of the surface, not to a physical quantity. The value of some selected physical quantity might be reported at the point of zero charge, e.g., the potential at the point of zero charge ($E_{\text{p.z.c.}}$?). In contrast, the 'isoelectric point' (i.e.p.) according to a proposal under consideration by the Commission, might be given a new definition indicating a physical quantity, i.e., the negative logarithm of the concentration of potential determining ions at zero electrokinetic potential, and would then not merely relate to a condition as defined in the present section 1.11.

Re 5.1 and 5.1.1—Considering Q as the quantity derived from the LIPPMANN equation where γ was the experimental interfacial tension, was only unambiguous for LL interfaces, not for SL interfaces for which it should be stated that γ was a defined quantity, not necessarily a measured quantity because contact angle measurements were ambiguous.

Re. Heading of 5—Instead of 'systems', the heading should specify 'electrodes', or perhaps 'electrode/electrolyte interfaces'.

Prof. EVERETT also mentioned that Commission I.6 planned to elaborate on interrelations of electrokinetic phenomena in Section 1.11 and to add the definition of dielectrophores.

Prof. HAUL felt that some group should draft proposals for definitions in the area which might be called 'dry electrochemistry', to deal with such quantities as contact potentials, work functions, surface dipole moments, etc., and including terminology for semiconductor surfaces.

It was agreed that Commission I.3 would deal exclusively with electrode-electrolyte systems, including electrode reactions. Commission I.6 would deal, in addition to the colloidal systems, with dry electrochemistry, and develop terminology in that area. The Secretary was requested to obtain information from the American Institute of Physics on presently adopted classification in this area by the physics community.

- (iv) Prof. J. KRATOCHVIL (Clarkson College of Technology, Potsdam, NY) had been invited to prepare a draft for terminology and symbols for light scattering, to replace a corresponding section which was originally intended for inclusion in Part I (as Section 1.13), but which was omitted in view of ongoing developments of optics terminology elsewhere. In the meantime, Commission I.1 had revised Section 2.8 of the Green

Book by proposals contained in Tentative Nomenclature Appendix No. 24 to the *Information Bulletin* (June 1972): 'Recommended Names and Symbols for Light and Related Electromagnetic Radiation'. Unfortunately, Prof. KRATOCHVIL was unable to have a draft ready for discussion at the present meeting, but he would submit one for discussion by correspondence in due course.

- (v) Another section which, in view of ongoing developments in the community of rheologists, was omitted when Part I was published, dealt with terminology and symbols for rheological properties of importance to the colloid and surface chemist. National rheological societies had recently established a formal International Committee on Rheology. This Committee had requested affiliation with IUPAC, which had been endorsed by the Commission.

One of the projects of the International Committee was to coordinate the development of an internationally adopted manual on terminology and symbols for rheology, to replace earlier unofficial guidelines such as those published by M. REINER and G. W. SCOTT BLAIR ['Rheological Terminology' in *Rheology* 4, 461 (1967)]. In order to promote the development of that part of the terminology which was of greatest interest to the colloid and surface chemists, the Secretary prepared a proposal for the most common properties, limited to simple shear situations, and excluding such areas as viscoelasticity for which comprehensive terminology was being developed by the rheologists. This proposal had been discussed with Dr. R. S. MARVIN, Chairman of the International Committee on Rheology, and with Prof. F. R. EIRICH, President of the US Society of Rheology. The Commission further discussed the proposal and agreed to submit the draft with some modifications to the International Committee with an accompanying letter explaining the interests of Commission I.6 in this area. The Commission would also send a copy to the International Commission on Terminology (CIT) of CID in order to promote coordination of terminology development in the area of rheology. The Macromolecular Division of IUPAC would also be consulted.

The Commission felt that it should also draft proposals for terminology on surface rheology, and Dr. MYSELS agreed to prepare a draft for discussion by correspondence.

3. Nomenclature of Zeolites and Molecular Sieves

The Commission discussed and amended the most recent draft on nomenclature of zeolites and molecular sieves which had been prepared by Prof. BARRER's Working Party. This group included representatives from Commission II.2 and Members of the crystallographic and mineralogical communities representing IUCr and IMA informally. The amended draft was further discussed between Members of I.6 and the full Commission II.2 in joint session. The proposed draft as amended would be submitted for further comments during the International Conference on Molecular Sieves, scheduled for September 1974 in Zürich. The Working Party was asked to prepare a provisional draft for publication as a Tentative Nomenclature Appendix to the *Information Bulletin* after the Zürich Conference.

4. Standard Reference Materials

- (i) The Commission noted with satisfaction the progress which had been made by the SCI-IUPAC-NPL Working Party in UK, which had resulted in the establishment of four surface area standards, which were now available from NPL. The Commission suggested that the Working Party be asked to remain available as consultants to NPL where the project had become part of the scientific programme. The need was expressed for a note on recommendations for measurement of surface areas and guidelines for the use of the surface area standards. The Chairman agreed to ask the Working Party to collaborate in preparing such a note.

Several of the samples distributed by the Working Party had given unsatisfactory results for different reasons, e.g., the irreproducibility of outgassing procedures for silica, and too large a grain size in the case of the charcoal sample. Further work was considered desirable (such as a study on helium washing of silica, and reduction of the grain size of charcoal) in order to extend the range of materials, and to improve precision with which the standards were characterized. The Commission expressed its wish to be kept informed on the project, and agreed to publicize the availability of the standards in their respective countries. The Chairman mentioned that a questionnaire had been distributed in UK to obtain information on the desired range of standards. Copies of this questionnaire as well as information sheets from NPL would be obtained for distribution to the Membership of the Commission.

- (ii) As reported before, Dr. R. L. Moss (Warren Spring Laboratory of the UK Department of Industry) had approval for a project of preparing and characterizing a standard reference catalyst. The Commission had communicated with Dr. Moss to express its interest in the project. The Commission suggested that the same procedure be followed as with the area standards development project, and that SCI be asked to set up a small Working Party with the Warren Spring Laboratory and with Prof. KEMBALL representing IUPAC. Prof. BURWELL asked that the Working Party submit its plan of action for the project to others for comment and suggestions, including the Members of his Project Group on Part II.
- (iii) The Secretary reported that the NAS-NRC Committee on Colloid and Surface Chemistry in USA had abandoned its attempts to establish a programme for the preparation and distribution of pure surfactants for research purposes. None of the Companies contacted was interested in preparing a small batch of highly purified material, and it was also recognized that methods of preparing samples of high purity, including homologue purity, were now well established and intermediates of high purity had become available from small specialized commercial laboratories. Hence, it was felt that the researcher could well synthesize purified samples himself, or he could avail himself of services from commercial laboratories.
- (iv) The Chairman mentioned that Commission I.4 had been kept informed about the efforts of the Commission in the area of standards, and the four area standards would be listed by IUPAC in a future revision of the *Catalog of Physicochemical Standard Substances*.

- (v) It was noted that the Clay Minerals Society in USA made available reference samples of source clays from homogenized batches of hand picked clay minerals. A number of basic data on these samples (including, for example, surface area data) were being collected.

5. Data Evaluation and Compilation

The Secretary reported that the output of the National Standard Reference Data System (NSRDS) in USA was now being published in a new quarterly journal called *Journal of Physical and Chemical Reference Data*, issued jointly since 1972 by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. Reprints of individual compilations were made available. Of special interest to the Commission was 'The Surface Tension of Pure Liquid Compounds' by J. J. JASPER [1, 841 (1972)]. Electrochemical and electrokinetic data were being compiled by a group headed by Prof. J. LYKLEMA, under the auspices of NSRDS.

6. Presentation of Data in Primary Literature

Prof. E. F. WESTRUM, Jr., Chairman of the CODATA Task Group in this area, kindly agreed to present the views of the Task Group to the Commission. The Task Group had prepared a draft of general recommendations, a copy of which was distributed to Commission Members. This recommendation would be modified on the basis of comments received. The Task Group visualized that specific guidelines in various disciplines would be drafted by appropriate groups, and perhaps a greater number of such guidelines would be prepared in subdisciplines. Several such guides had already been prepared earlier as listed in the bibliography of the draft from the Task Group, and Prof. WESTRUM said that it was his personal experience as an editor of thermodynamic journals that the guidelines for thermodynamics had resulted not only in improving the presentation of data, but also in promoting good experimentation.

Prof. EVERETT wondered how far it would be feasible to follow the guidelines because they would result in increasing the length of papers, at a time when there were strong pressures to reduce the size of publications. Prof. KEMBALL felt that adherence to the rules would hasten the day that new publication techniques would have to be adopted. Prof. WESTRUM noted that the required detail was already provided in many good papers, and he felt that complying with the recommendations would result only in a relatively small increment in size of most papers, and that very extensive data could be deposited in a recoverable form.

Prof. KEMBALL noted that, particularly in the areas of colloid and surface chemistry, often only 'sloppy' data could be obtained, which were, however, very useful. Any guidelines should allow presentation of such data. Prof. WESTRUM agreed, and pointed out that in the thermodynamics manual there was, for example, an 'escape clause' for DTA data.

Several Members felt that the Task Group draft should contain a recommendation on the way references should be handled. Prof. WESTRUM pointed out that in his opinion such recommendations belonged in style manuals, but he was willing to reconsider the matter.

The Commission recognized the value of guides to the presentations of data in the primary literature. Prof. HAUL had prepared a brief draft dealing with the presentation of adsorption data. He was requested to enlarge this

proposal, with proper consideration of the Task Group's recommendations as well as of 'Guide to Procedures for Publication of Thermodynamic Data' [*Pure Appl. Chem.* **29**, 395 (1972)] as far as thermodynamic adsorption data were concerned.

Dr. MYSELS submitted a draft on 'Reporting Experimental Data Dealing with Critical Micellization Concentrations (c.m.c.'s)' by K. J. MYSELS and P. MUKERJEE. Commission Members were requested to give their comments in writing to Dr. MYSELS.

The Commission noted a draft on the presentation of data in chemical kinetics, prepared by the CODATA Task Group on Chemical Kinetics. A short section of this draft, dealing with reactions at solid surfaces, was considered unsatisfactory, and Prof. BURWELL agreed to rewrite this section, to be submitted to the Task Group.

Closely related to the above topics was the preparation of 'Guidelines for Measurement Procedures in Colloid and Surface Chemistry'. Work on the standard reference materials for surface area determination had highlighted the need for such guidelines. Commission I.6 proposed to initiate projects of this kind in addition to the project on surface area measurement procedures. Appropriate recommendations would be submitted to Commission I.4 for inclusion in its series on recommendations for calibration and test substances.

7. Education

The Secretary reported that most contributions for the Resource Book had been received, reviewed, and edited. The Foreword, Table of Contents, and several sample pages of the manuscript were distributed. With regard to the publication of the book, the Secretary mentioned that Butterworths had indicated that they would not be interested in publishing it, and the Committee on Teaching of Chemistry, although expressing its appreciation for the value of the book, felt that IUPAC would be financially unable to support publication (as well as several other educational publications submitted to the Committee). The Committee recommended that IUPAC should release publication rights, allowing the Commission to seek a publisher elsewhere. The Secretary was now exploring the possibility of publication through the American Chemical Society.

8. Liaison with CID and ISO

CID (Comité International des Dérivés Tensio-Actifs) had become an Associated Organization of IUPAC in 1971. The Commission maintained liaison with CID, and Prof. H. LANGE had acted as liaison representative. However, the Commission noted that liaison had been inhibited by the lack of funds to enable the representative to attend meetings of CID groups in which topics of interest to the Commission were discussed. It was considered desirable that such funds be made available for this purpose in 1973-4.

CID organized the International Congresses on Surface Activity which had been held every four years. The Commission noted that the VI Congress (1972) had been given IUPAC sponsorship. It was understood that some of the reservations expressed by Commission I.6 were substantiated by the results of the questionnaire circulated by Prof. H. ZOLLINGER (President of the Scientific Committee of the Congress) among the members of his Committee and Session Chairmen of the Congress. Therefore, Commission I.6

recommended that any future application for IUPAC sponsorship of these Congresses be examined carefully.

Several Commissions of CID provided input to the relevant Technical Committee of the International Standards Organization (ISO/TC 91), on standardization of terminology through CIT (Commission Internationale de Terminologie), of methods of analysis through CIA (Commission Internationale d'Analyses), and on physical property measurements through CIE (Commission Internationale d'Essais). From both CID-CIT and ISO/TC 91 the Commission had received proposals on terminology throughout the years, and comments were submitted in accordance with the Commission's own Manual where overlap of terms occurred. Proposals originating in CID-CIT were routinely submitted to ISO/TC 91 which circulated them to member nations to solicit comments from their national standards organizations. Final glossaries were then submitted to voting by the member nations and published as an ISO Recommendation. In March 1971 a glossary of terminology on 'Surface Active Agents' was published as ISO Recommendation R862 in English, French, and Russian, which departed in several significant respects from the recommendations in Part I of the Commission's Manual. The discrepancy between IUPAC recommendations and ISO recommendations was to be regretted, particularly because the ISO recommendations were likely to be used by persons in the detergent field, an important segment of the community of colloid and surface chemists. It was felt that the Commission should take a more active part in relation to CID-CIT matters than in had it recent years.

The Commission had also received regularly proposals for methods of analysis of detergents, *etc.*, but it had not reacted on these because this matter was outside the interest of Commission I.6.

Communications from CIE on physical property measurements had been sent to the Commission only very recently and it appeared that proposals for some property measurements were already in an advanced stage of development, *i.e.*, ready for submission to ISO. The Commission would undoubtedly receive copies of recommendations from ISO (as was the case with those originating within CIT and CIA), but the Commission should perhaps interact at an earlier stage.

Through the IUPAC Secretariat, the Commission received invitations to send a representative to meetings of both the Commissions of CID and TC 91 of ISO, but as mentioned, lack of funds had made it difficult for a Commission Member to attend regularly. The Chairman noted that Dr. S. FRIBERG had recently become Vice-President of CID, and it was agreed to ask Dr. FRIBERG to become the Commission's liaison representative to CID, to replace Prof. LANGE, whose term as Associate Member of Commission I.6 now expired. The Secretary mentioned that he had requested and obtained personal membership of the ASTM Committee D-12, which acted as the US National Committee for ISO/TC 91 on behalf of American National Standards Institute (ANSI). His participation in this Committee would allow him to influence the US vote on ISO recommendations, and to transmit comments on proposals.

9. Future Meetings and Future Activities

- (i) The 1975 IUPAC Congress would be held in Jerusalem. Dr. J. A. EPSTEIN (Israel) discussed with the Commission the possible inclusion of one or more sessions on colloid and surface chemistry in the prog-

ramme. According to present plans the following areas would be in the programme: Organic, Physical, Medicinal, Applied, and Macromolecular Chemistry. Dr. EPSTEIN was responsible for coordinating the programme on Applied Chemistry, covering a total of eight half-day sessions. He proposed to devote one half-day session (one plenary talk and six lectures) to application aspects of surface chemistry. Other sessions included one on desalination and one on pollution. Included in the Physical Chemistry programme would be a session on interfacial electrochemistry.

Dr. EPSTEIN mentioned the following topics as appropriate for the surface chemistry session: flotation, high temperature systems (gas-solid and solid-solid interactions, *e.g.*, sintering of refractories), and novel catalytic processes. He asked the Commission for comments and possible alternative suggestions. The Commission felt that it would perhaps be better to concentrate on liquid phase problems and omit high temperature topics, unless a second session could be reserved for surface phenomena.

- (ii) With several of the current projects being expected to reach the terminal stage within the next two years of consolidation, the Commission discussed in which direction it should go from a longer range point of view. The Commission endorsed the suggestion made by Dr. FRIBERG in writing that it would be within the purview of the Commission to consider liquid crystal systems, and to develop much needed terminology in this area. The Commission proposed that Dr. FRIBERG be invited to prepare a first draft with consultation of such other experts as he would feel appropriate.

The Commission also considered the time ripe to embark on appropriate projects related to the behaviour of solid surfaces, an area usually considered the domain of surface physicists, and including the area referred to above as 'dry electrochemistry'. Prof. HAUL was asked to find out what physicists had been doing on matters of terminology, symbols, *etc.*, and to draft a plan of action for the Commission.

10. Membership

The Commission voted unanimously to nominate Dr. MYSELS as Chairman for the period 1973-5. Prof. VAN OLPHEN would continue to serve as Secretary until his term of office expired in 1975. The terms of office of the following Titular Members were extended for a further four years (1973-7): Prof. R. L. BURWELL, Jr., Prof. R. HAUL, Dr. V. B. KAZANSKY, Dr. K. J. MYSELS. The following new Associate Member was nominated: Prof. J. LYKLEMA (Netherlands).

INORGANIC CHEMISTRY DIVISION COMMITTEE

22 August 1973

Present: Prof. O. GLEMSE (President), Prof. V. GUTMANN (Vice-President), Prof. L. MALATESTA (Secretary), Prof. R. COLLONGUES, Prof. N. N. GREENWOOD, Dr. W. S. HORTON, Prof. A. MAGNÉLI, Prof. A. SWINARSKI, Prof. A. A. VLČEK, Prof. K. YAMASAKI.

1. Prof. GUTMANN requested the Commission Chairmen to provide the new Membership lists for the Division Committee meeting on 27 August and to provide, too, a short summary of the work of their Commissions at Munich for the verbal report of the President of the Division to Council.

2. The Division Committee discussed and approved the preliminary reports of the Commissions and the agenda for each Commission Meeting:

- (i) *Commission II.1* (Prof. GREENWOOD). There was much disappointment with Butterworths, both for the delay of publication and for the quality of reprints of 'Atomic Weights of the Elements 1971'. The Commission should prepare a written request why Prof. GREENWOOD must be able to continue as Chairman for a further two years.
- (ii) *Commission II.2* (Prof. FERNELIUS). As in the case of Commission II.1, II.2 should prepare a written request why Prof. FERNELIUS must be able to continue as Chairman for a further two years. Prof. FERNELIUS asked for a meeting of Commission II.2 in 1974. The Committee agreed that this meeting would have priority over any other meeting of the Division in that year.
- (iii) *Commission II.3* (Dr. HORTON). Dr. HORTON asked for a meeting of Commission II.3 in 1974. The Committee was in favour with this proposal. The President believed that a certain sum could be provided from the Division funds.

27 August 1973

1. The Division Committee discussed and approved the final reports of the Commissions. In particular, the following points were discussed:

- (i) *Commission II.1*—changes in atomic weight values and presentation of data.
- (ii) *Commission II.2*—names for elements 104 and 105 and for new elements and nomenclature questions: problems at the boundary of inorganic and organic chemistry, multiple bonded systems as ligands, *etc.*, radical nomenclature, ring and chain compounds, a revision and extension of the rules for naming boron compounds, study of the nomenclature of cluster compounds, nomenclature of iso- and heteropolyacids.
- (iii) *Commission II.3*—choice of standards for melting points and vapour pressure of metals, standardization of X-ray diffraction results up to 1200°C.

The Division Committee approved the elections in the Commissions. It agreed that the Commission on High Temperatures and Refractory Materials should be increased to eight Titular Members.

2. The recommendations from the Division Committee to Council in Munich were the following:

- (i) To approve a press release about the recommended changes in atomic weight values for nickel and rhenium. For 17 radioactive elements the atomic mass number of the isotope of that element of largest known half-life should be given in parenthesis, namely for Tc, Pm, Po, At, Rn, Fr, Ac, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr.
 - (ii) In the case of the names of elements 104 and 105, to approve the appointment of a committee of neutral experts of IUPAC and IUPAP to resolve or otherwise advise on the question of priority.
 - (iii) To support a proposal for publication of a system of names of elements with atomic number higher than 105 based on their actual atomic numbers.
3. The new Division Committee after the elections was as follows: Prof. V. GUTMANN (President), Prof. L. MALATESTA (Vice-President), Prof. A. A. VLČEK (Secretary), Prof. K. W. BAGNALL, Prof. R. COLLONGUES, Prof. W. C. FERNELIUS, Prof. E. FLUCK, Prof. A. MAGNÉLI, Prof. A. SWINARSKI, Prof. K. YAMASAKI.

COMMISSION ON ATOMIC WEIGHTS (II.I)

22–25 August 1973

Present: Prof. N. N. GREENWOOD (Chairman), Mr. H. S. PEISER (Secretary), Dr. A. E. CAMERON, Prof. S. FUJIWARA, Prof. W. H. JOHNSON, Dr. W. W. MEINKE, Prof. E. ROTH (Titular Members); Dr. P. DE BIÈVRE, Dr. N. E. HOLDEN, Prof. H. G. THODE, Prof. A. H. WAPSTRA (Associate Members).

I. Minutes of Previous Meeting

These had been published in *Comptes Rendus XXVI Conference* (pages 134–136).

2. Membership

The Commission was in the middle of an important technical transition phase and therefore unanimously requested the extension of the appointment of its Chairman, Prof. GREENWOOD, for an exceptional and final two-year period of Titular Membership. The Commission noted with great regret the resignation from Titular Membership of Dr. A. A. SMALES. Prof. E. ROTH was recommended for a second term of four years as Titular Member; but Dr. A. E. CAMERON who, with a short interruption due to temporary ill health, had been prominently associated with the work of this Commission since its inception, preferred to be nominated only for transfer to Associate Membership. Dr. P. DE BIÈVRE and Dr. N. E. HOLDEN were recommended for Titular Membership after two years of devoted and valuable service as Associate Members. Prof. H. J. SVEC had completed a six-year term as Associate Member. New appointments to Associate Membership were recommended for Prof. R. L. MARTIN (Australia) and Prof. N. SAITO (Japan).

3. Changes in Atomic Weight Values

The following changes were agreed:

Nickel from 58.7_1 to 58.70

Rhenium from 186.2 to 186.207

The change for nickel arose from a reevaluation of existing data and the likelihood that one mass spectrometric value overemphasized the concentration of ^{64}Ni . This brought the chemical and mass spectrometric values into close agreement, thereby permitting the increased precision with which the value was quoted. The change for rhenium increased the precision of the quoted value by two orders of magnitude and was based on recent mass spectrometric work of the highest quality done at US National Bureau of Standards. Other possible minor changes were considered but were thought to be premature at this stage.

4. New Listings

The Commission was concerned at the absence of any atomic weight values in the Atomic Weights Table for certain artificial or highly radioactive elements. After very careful consideration of various possibilities, it agreed to include seventeen new listings in parenthesis, with the following explanatory note:

‘A whole number in parenthesis denotes the atomic mass number of the isotope of that element of longest known half-life.’

With this decision the Commission reverted essentially to its 1955 practice.

Tc	Pm	Po	At	Rn	Fr	Ac	Pu	
(97)	(145)	(209)	(210)	(222)	(223)	(227)	(244)	
Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
(243)	(247)	(247)	(251)	(254)	(257)	(258)	(259)	(260)

Further information on the precise relative atomic mass of selected individual isotopes of these elements would continue to be given in the appropriate Table as at present.

5. Annotations to Footnotes

The annotation to the Table footnotes *a-g*, which had previously been made as superscripts to the atomic weight values, would in future be listed in a separate column. New annotations were added as follows:

e.....Ne, Kr, Xe
g.....Os, Th, U

Appropriate additions would be made to the data in the Table of Relative Atomic Masses of Selected Nuclides. Other potential candidates for future addition of annotations would be discussed in the full Report to be published in *Pure and Applied Chemistry* in 1974.

6. Representation of Reliability of Atomic Weight Values

The Commission considered this problem and the difficulties which had arisen from the use of subscript numerals to indicate a reliability of ± 3 in the last significant figure (a numeral printed online implying a reliability of ± 1 in the last significant figure). It now proposed to print all numbers online but to indicate by an asterisk (*), those values where the last digit was considered reliable only to ± 3 . Such an indication could, if required, be carried through a calculation made by a computer or otherwise.

7. Variability of Atomic Weights

A continuing and ever growing concern of the Commission was the variability of atomic weights relative to the achievable precision of measurements. Such variations were known to occur for many elements as found in nature. In addition, the products of manufacturing processes, which affected the isotopic composition of the elements, were becoming more widespread. Whereas at one time atomic weights were thought to be universal constants of nature, their actual variability was progressively becoming a matter of practical importance. The Commission would welcome both discussion and advice as it strove to alert chemists and the chemical trade generally to the dangers which arose from the false assumption that atomic weights of elements were always constants.

8. Isotope Abundance Data

The Commission had asked a group of its Members to begin a critical evaluation and tabulation of all published isotope abundance data. Variability in nature, precision of measurements, mass spectrometrically computed atomic weights, and attainable accuracy would be considered. This was a major undertaking and progress would be reviewed at frequent intervals.

9. Joint Meeting with Officers of Committee on Teaching of Chemistry

A most useful meeting was held and Commission Members agreed to collaborate with the Teaching of Chemistry Committee in preparing a 'Table of Atomic Weights to Four Significant Figures' to be published by that Committee. A short statement concerning the variability of atomic weights in nature and the possible variation caused by processing would also be prepared. It was thought to be inappropriate for the Commission on Atomic Weights to publish this 'simplified' Table, but the Commission welcomed an opportunity to give expert help and advice on this most important matter.

COMMISSION ON NOMENCLATURE OF INORGANIC CHEMISTRY (II.2)

21–26 August 1973

Present: Prof. W. C. FERNELIUS (Chairman), Prof. K. A. JENSEN (Vice-Chairman), Prof. J. CHATT and Dr. G. J. LEIGH (Acting Co-Secretaries), Prof. R. M. ADAMS, Prof. L. F. BERTELLO, Dr. K. C. BUSHBECK, Prof. Y. JEANNIN, Prof. B. F. MYASOEDOV (Titular Members); Dr. W. H. POWELL, Prof. A. A. VLČEK, Prof. E. WEISS, Prof. K. YAMASAKI (Associate Members); Dr. D. M. P. MINGOS (Observer).

1. The Chairman reminded the Commission of its great loss on the death of Prof. J. E. PRUE (Secretary) and the Commission stood in silence in his memory.

2. The Minutes of the previous meeting in Washington, DC, 15–20 July 1971 (see *Comptes Rendus XXVI Conference*, pages 137–139), were approved. It was noted that the Working Groups had not developed according to the programme there laid down, and the exact remit of the Working Groups was to be redefined during the present meeting.

3. The Chairman introduced Dr. MINGOS. It was agreed that he be recommended to the Bureau to be elected a Titular Member and with the intention that he should become Secretary.

4. The proposal, from the Swedish National Committee for Chemistry, that the Groups of the Long Form of the Periodic Table should be renumbered from 0 to 17 (noble gases=zero) was discussed at considerable length. It was decided not to recommend the proposed system because:

- (i) The new system of numbering would only introduce further confusion by giving new meanings to internationally accepted Group numbers.
- (ii) The Long Form of the Table was not correct in principle.

5. *Torben Svane's Spiral Form of the Periodic Table.* This was not considered to be a problem of nomenclature and Prof. JENSEN agreed to explain the matter to SVANE on behalf of the Commission.

6. *Cheesman and Finney Report on Codification of Chemical Symbols and Formulae for Digital Computer Use.* It was agreed that Chemsript A, which was essentially the system used by Chemical Abstract Service (CAS), was generally satisfactory. This report would be referred to the Interdivisional Committee on Machine Documentation in the Chemical Field.

7. *Two-letter Symbols for all Elements.* Correspondence with spectroscopists had indicated a desire for two-letter symbols, to avoid typographical confusion in the IBM print out. It was noted that this matter, so far as iodine and vanadium were concerned, had been dealt with on page 10 of the 1970 edition of *Nomenclature of Inorganic Chemistry* (the Red Book). Dr. POWELL reported that CAS had encountered no problems using the single-letter element symbols.

8. *Names of Elements 104 and 105.* Profs. FERNELIUS and JENSEN reviewed the present situation, and the Commission discussed this problem in some detail. Although the selection of an element name by the Commission generally 'carries no implication regarding priority of discovery' (Red Book, paragraph 1.12), it was felt that, for these two elements, names could not be decided upon without first resolving the controversy surrounding their dis-

covery. Because this was outside the sphere of competence of the Commission, it was decided to recommend to the Inorganic Chemistry Division Committee that a committee of neutral experts should be appointed in collaboration with IUPAP to resolve the question of priority. If for any reason this could not be done, the elements should be named by an extension of the method proposed for elements of atomic numbers greater than 105 (see Item 9 below).

9. *Elements of Atomic Numbers greater than 105.* There was a thorough and wide-ranging discussion about the need to name these elements and the types of names and symbols to be allotted to them. It was noted that some of the above elements were receiving much more mention in publications than the known elements 104 and 105. It was decided that names were needed for indexing purposes and that the Commission should suggest some systematic nomenclature. The Chairman stated that whatever names the Commission recommended, its action would not deny the right of 'discoverers' of new elements to suggest new names for them. It was decided that the names should accord with the following principles:

- (i) The names should be short and obviously related to the atomic number of the element.
- (ii) The names should end in 'ium' whether the element was expected to be a metal or otherwise.
- (iii) The symbols for the systematically named elements should consist of three letters.
- (iv) The symbols should be derived directly from the atomic number and be visually related to the names as far as possible.

The various systems proposed as a result of discussions at the Washington meeting, and that submitted by J. BEAUCHAMP, were considered, but none was found completely satisfactory in the light of the above principles. Finally, it was decided to recommend a system in which names and symbols were directly derived from the following numerical roots: nil=0, un=1, bi=2, tri=3, quad=4, pent=5, hex=6, sept=7, oct=8, and enn=9. These roots, easily recognisable by most chemists, were a mixture of Latin and Greek, ordinal and cardinal roots, chosen to give a unique series of initial letters for use in the symbols, and to produce names which were pronounceable in most languages.

Example names and symbols were as follows:

<u>Atomic number</u>	<u>Name</u>	<u>Symbol</u>
106	Unnilhexium	Unh
107	Unnilseptium	Uns
108	Unniloctium	Uno
109	Unnilennium	Une
110	Ununnilium	Uun
111	Unununium	Uuu
112	Ununbium	Uub
113	Ununtrium	Uut
114	Ununquadium	Uuq
115	Ununpentium	Uup
116	Ununhexium	Uuh
117	Ununseptium	Uus

118	Ununoctium	Uuo
119	Ununennium	Uue
120	Unbinilium	Ubn
121	Unbiunium	Ubu
130	Untrinilium	Utn
140	Unquadnilium	Uqn
150	Unpentnilium	Upn
160	Unhexnilium	Uhn
170	Unseptnilium	Usn
180	Unoctnilium	Uon
190	Unennilium	Uen
200	Binilnilium	Bnn
201	Binilunium	Bnu
202	Binilbium	Bnb
300	Trinilnilium	Tnn
400	Quadnilnilium	Qnn
500	Pentnilnilium	Pnn
900	Ennilnilium	Enn

10. *Boron Compounds*. There was a general discussion of the principles of metalloborane nomenclature and whether metalloboranes should be named according to substitution, coordination, or cluster compound nomenclature. Also, there was a detailed discussion of nomenclature proposals by Prof. M. F. HAWTHORNE to accommodate the newly discovered complex heteroboranes and the document 'Revisions of proposed IUPAC Boron Rules' dated 12 July 1973 by Prof. ADAMS. Amendments to the published rules [*Pure Appl. Chem.* 30, 681 (1972)] were discussed, and Prof. ADAMS and Dr. POWELL were asked to prepare a draft which would take account of all the suggested revisions.

11. *Nomenclature of Unsaturated Ligands*. The document dated 16 August 1973 and prepared by Dr. LEIGH pointed out difficulties in the naming of certain unsaturated ligands and specifying their points of attachment to the metal. To resolve this latter point, it was agreed that a system for the allocation of locants to all atoms of an organic compound was needed. It was also recommended that when an anionic ligand was derived from an unsaturated organic radical incapable of independent existence, the radical be named by 'hydro' nomenclature. The relevant Working Group would draft tentative rules for the next meeting.

With the designation of the point of attachment of metals to ligands, the 'hapto' nomenclature might become redundant. There was already evidence that the hapto nomenclature was being distorted to indicate the 'points of attachment' of polydentate ligands with nonadjacent ligating atoms. Also, it was noted that there was no hard dividing line between cluster complexes and some types of complex with unsaturated molecules or groups as ligands. Thus, the nomenclature of complexes with unsaturated ligands could not be considered in isolation from that of cluster complexes.

12. *Nomenclature of Inorganic Hydrides and Derived Radicals*. Dr. POWELL introduced a paper on this topic. He suggested that the names of mononuclear hydrides could be adapted to indicate the valency state of the central

atom by either introducing new word endings or by adding λ valence designators. Such substitute names would also be useful for describing radicals and highly fluorinated derivatives. The proposal to indicate the number of hydrogen atoms in a hydride by systematic changes of vowel in the names did not find favour. For the higher, and often hypothetical hydrides, coordination nomenclature seemed much more appropriate, and it was generally considered that coordination nomenclature should be used, except in those areas where substitution nomenclature was already well established. It was agreed that the 'io' nomenclature introduced as rule 3.41 of the tentative version of Section D of *Nomenclature of Organic Chemistry* (the Blue Book), which used coordination nomenclature, together with the λ or σ number, gave greatest promise of producing a universal and unambiguous nomenclature for inorganic compound-radicals and their equivalent anionic ligands.

13. At a joint meeting with representatives of the Commission on Nomenclature of Organic Chemistry (III.1), it was noted that reorganization of the Interdivisional Commission on Nomenclature and Symbols was proposed to scrutinize documents from the various Nomenclature Commissions to avoid conflicting usage. The following problems were discussed:

- (i) *Isotopically Labelled Compounds*. Three major practices had been established and used by inorganic, organic, and biochemists. The inorganic practice had historical precedence, but was now little used. The Inorganic Nomenclature Commission agreed that it would look sympathetically at any compromise solution between the organic chemists and biochemists with a view to recommending its adoption by inorganic chemists. The Organic Nomenclature Commission would prepare a draft document on this subject, copies of which would be provided for the Chairman and Secretary of the Inorganic Nomenclature Commission.
- (ii) *Problems on Borders between Inorganic, Organic, and Biochemistry*. Problems were arising from the use of capital letter codes by biochemists for well defined organic and inorganic substances. This was leading to an enormous index of such codes, many of which were unnecessary and bore little relation to the substance represented, e.g., CBL was equivalent to cobalamin. It had been proposed that the nickel analogue should be NBL and the copper analogue, which could not be CBL, should be UBL. Further, there was a tendency to develop similar names and symbols for relatively simple organic or inorganic compounds which were related to neutral products, e.g., cobaloximes related to cobalamines. Both Commissions were agreed that such trivial names and abbreviations for well defined substances should be avoided, but that the only practical steps which might be taken would be to encourage the editors of chemical journals to refuse such names and abbreviations.
- (iii) *Nomenclature of Radicals*. There was a far ranging discussion of radical nomenclature, including the suggestion that free radicals should be named differently from combined radicals. The new 'io' system of nomenclature, based on the element name, was discussed and found favour in its present rudimentary form for all radicals except those having the free valence on carbon, nitrogen or oxygen. No objection was raised to the formation of 'io' radical names strictly according to the rules of coordination nomenclature, with perhaps a λ designator to show the linkage valence of the atom carrying the free valence.

It was agreed that the nomenclature of sulfur radicals had become

ambiguous and difficult owing to too extensive a use of 'thio', which should be reserved for divalent sulfur. This difficulty permeated the whole nomenclature of sulfur compounds, which it was agreed required a thorough study and revision. It was recognized that the use of 'sulfurio' in place of 'thio' in certain types of radical nomenclature would clarify the situation.

- (iv) *Bonding of Multidentate Ligands to Metal Atoms or Ions.* Coordination chemists now required a system for numbering the atoms of organic compounds in order to indicate atoms which were not normally numbered, but which could act as ligating atoms, e.g., oxygen in an ester. The Organic Nomenclature Commission reported that it required a similar system to indicate which atoms in an organic compound had been isotopically labelled. It was developing two methods for this purpose. One of these would be suitable for simple compounds, and the other, based on replacement nomenclature (the oxa-aza convention) but including heteroatoms at the end of a chain, would be useful for more complicated compounds.
- (v) *Odd Electron Acids and Ligands.* There was considerable discussion of odd electron acids and derived ligands. The Inorganic Nomenclature Commission proposed a 'hydro' system. The Organic Nomenclature Commission saw no immediate objection to this, but reserved judgement until proposals were formulated.
- (vi) *Nomenclature of Complex Ring Systems.* The methods being developed by the Organic Nomenclature Commission for numbering and naming complex ring systems, using a method of collapsing well defined organic units and treating them as single units, were outlined. It was thought that this system might also have application in the nomenclature of aggregates of metal clusters.

14. At a joint meeting with the Colloid and Surface Chemistry Commission (I.6), the paper 'Suggestions for Chemical Nomenclature of Synthetic and Natural Zeolites' was discussed with a representative of the Zeolites and Molecular Sieves Nomenclature Working Party, Prof. R. M. BARRER. Certain amendments were suggested. Commission I.6 stated that the original document and suggestions would be considered by the appropriate mineralogical organizations and also by interested bodies at the III International Conference on Molecular Sieves in Zürich in September 1973. The modified document would then come back to Commission I.6 for reappraisal with Commission II.2.

15. *Nomenclature of Metal Cluster Compounds.* The possibility of using an 'ane' type of nomenclature for metal clusters, chains, and rings was explored in some detail. The Commission considered this a promising approach but felt that the 'ane' ending to the names might be modified to avoid confusion with organic substitution nomenclature.

The problem of nonclosed polyhedral clusters was then discussed. Difficulty arose in attempts to apply the 'polyhedro' type nomenclature to such systems because geometers had not given names to the relevant polyhedra. It might be necessary to invent names or to build up the polyhedra as aggregates from the clusters of three or four metal atoms each.

16. It was agreed that it was desirable to codify existing use of punctuation marks in names and formulae to avoid future conflicting use in different branches of chemistry.

17. *Nomenclature of Highly Fluorinated Inorganic Compounds*. The document prepared by Prof. FERNELIUS and Dr. POWELL, listing names formed (a) according to the rules of substitution nomenclature, and (b) according to the rules of coordination nomenclature, together with other recognized names, was considered. It was agreed to defer a decision until principles for the nomenclature of inorganic radicals, rings, and chains had been established.

18. *Nomenclature of Anionic Chain and Ring Structures* (iso- and heteropolyanions). A paper prepared by the late Prof. PRUE was considered and principles laid down for the development of a nomenclature of chains and rings of atoms without carbon. The Working Group on Chain and Ring Nomenclature was to prepare a document according to these principles, making amendments where necessary.

19. *Revision of the Red Book* (1970 Rules). It was noted that *cis* and *trans* were not used in inorganic nomenclature as they have been defined in Table III on page 103 of the Red Book, which would restrict their use to mononuclear complexes. After much discussion it was agreed that the Commission should study carefully the definitions of *cis* and *trans* in *Nomenclature of Organic Chemistry* to see how far they were applicable to complex compounds. The use of *sym* and *asym* in defining the configurations of planar bridged complexes was also to be reexamined.

20. *Errors in the Red Book*. Members of the Commission were asked to report to the Secretary any typographical or other errors which they noticed in the Red Book, for correction when reprinting became necessary.

21. *Section D: Rules for Organometallic Chemistry*. Members were asked to read these recently published rules [*Tentative Nomenclature Appendix No. 31* (August 1973) to *Inf. Bull.*] carefully and to report any errors to Dr. MINGOS. The second paragraph should be rewritten to state clearly that Section D was prepared jointly and equally by the Inorganic and Organic Nomenclature Commissions.

22. *Membership of Commission, 1973-1975*. The following Members retired or resigned between the time of the Washington meeting and the close of the Munich meeting: Profs. CHATT, HOLLIDAY, JENSEN, and WEISS. Dr. LEIGH was elected a Titular Member and Profs. CHATT and JENSEN as Associate Members, leaving a vacancy for one Associate Member. Two persons were proposed for this position and it was left to the Chairman to organize a mail ballot. Dr. MINGOS was elected Secretary. Prof. A. ÖLANDER was no longer eligible to serve the Commission as its representative on the Zeolites and Molecular Sieves Nomenclature Working Party. Prof. JEANNIN was elected in his place.

24. *National Representatives*. Prof. VLČEK suggested that the Commission should accept National Representatives to ensure that the Commission's decisions were adopted as widely as possible. This idea was welcomed, particularly because most countries had no formal nomenclature organization. However, the exact status of the proposed National Representatives was not decided, and the Chairman undertook to explore official possibilities, and to raise the matter with the Organic Nomenclature Commission.

The importance of the dissemination of Commission decisions was emphasized and various publication and advertising techniques were considered. It was noted that the Elsevier Publishing Company had agreed to reprint

the tentative version of Section D on the Nomenclature of Organometallic Chemistry in *Journal of Organometallic Chemistry*.

25. *Work Areas and Working Groups*. The following were agreed for the next meeting:

- (i) Isotopically labelled compounds (document to be prepared by Organic Nomenclature Commission)
- (ii) Inorganic radicals (FERNELIUS)
- (iii) Locant designators in ligands (JEANNIN and LEIGH in liaison with RIGAUDY from Organic Nomenclature Commission)
- (iv) Sulfur compounds (JENSEN in liaison with LOZAC'H from Organic Nomenclature Commission)
- (v) Inorganic boron compounds (ADAMS and POWELL)
- (vi) Cluster compounds (BERTELLO and JEANNIN)
- (vii) Ligands with multiple bonds (JEANNIN and LEIGH)
- (viii) Inorganic ring and chain compounds (BUSCHBECK)

26. *Next Meeting*. It was decided that this would be held during 1974 in Europe (Italy, UK, or Ireland), if Division funds were made available. Prof. FERNELIUS would determine the place and time of the meeting.

COMMISSION ON HIGH TEMPERATURES AND REFRACTORY MATERIALS (II.3)

23–25 August 1973

Present: Dr. W. S. HORTON (Chairman), Prof. G. D. RIECK (Secretary), Prof. C. B. ALCOCK, Prof. R. COLLONGUES, Prof. E. FITZER (Titular Members); Prof. J. HLAVÁČ, Prof. G. DE MARIA (Associate Members); Prof. A. MAGNÉLI (National Representative); Prof. M. FOEX, Prof. M. K. HUSSEIN, Dr. R. W. OHSE (Observers).

I. Minutes of Previous Meeting

The minutes of the meeting in Paris on 11–12 October 1972 [see *Inf. Bull.* No. 45 (May 1973), pages 42–44] were already approved by mail.

2. Reports on Task Forces

- (i) *High Temperature Bibliography.* A written report was received from the editor, Dr. M. G. HOCKING, and accepted by the Commission. The number of subscribers remained at about 400, despite the price increase. The financial report showed that the deficit had been reduced by about half, due largely to donations. The editor and the Chairman had decided to increase the subscription fee to £3.00.

Dr. HOCKING would be asked to compose a short letter which all Members of the Commission and contributors to the Bibliography could send to high temperature chemists not yet receiving the Bibliography and to national scientific journals. For this purpose Dr. HOCKING would be asked to send a relevant list of subscribers to the above-mentioned people. It was felt that a name list of scientists and laboratories active in the high temperature field would be useful. Each Member and contributor would try to have a list regarding his area, ready before the next meeting.

- (ii) *Melting Points.* Prof. FOEX presented a written report incorporating the results of seven laboratories for the melting point of Y_2O_3 with an average in the neighbourhood of $2440^\circ C$. In two more years an analysis of the data, including an exchange of results between the laboratories involved, could be furnished. The Commission would then decide whether Y_2O_3 would qualify as a standard. It expressed the opinion that the eutectics were potential standards, and that further work had to be done on ZrO_2 - $La_2Zr_2O_7$ concerning the evaporation of lanthanum oxide(s) during the measurement, e.g., by repeated determinations in vacuum.

The Commission suggested that Prof. FOEX should raise the question with scientists as to whether the determination of the melting point of a refractory metal, such as molybdenum, would be useful to them. Serious consideration of carbide systems as standards was deferred because of the full programme already in progress.

There seemed to be an advantage in using solid-solid transformations instead of melting points as temperature standards. The Commission decided to consider this further before taking action with respect to the higher temperatures.

- (iii) *Vapour Pressure.* Dr. R. C. PAULE was delayed in analysing the results for platinum. As to the measurements on tungsten, the Commission

felt very strongly the necessity that another laboratory should confirm the results from NBS. The Commission would request Prof. O. KUBASCHEWSKI to examine the results on the vapour pressure of gold, in order to explain the large deviations. Prof. DE MARIA was asked to present to the Members of the Commission and the Task Force a report on his calorimetric work on the heat of sublimation of cadmium.

3. Committee Reports

- (i) *Carbon*. Prof. FITZER reported on the progress both on the characterization and the nomenclature of carbon. He agreed to be the coordinator of a new Task Force for this field (DONNET, HORTON, NODA, MRZOWSKI, UBBELOHDE).
- (ii) *High Temperature X-ray Work*. Prof. FOEX, Chairman of an IUCr Commission on Crystallographic Studies at Controlled Pressures and Temperature, presented a written report on the activities of his Commission. Dr. TRAVERSE would be asked to write a more critical report on methods and samples than the existing one. Commission II.3 felt also the need for standards for temperatures of 1200°C and below, to be used in X-ray diffraction. It was decided to ask Prof. FOEX to distribute to specialists samples for this purpose in order to obtain data on lattice expansion and on transitions at elevated temperatures (gold, alumina, quartz, and some other substance).
- (iii) *Task Force on Solid-solid Transitions*. The Commission considered that solid-solid transitions could very well be used for temperature standards in a wide range of experimental techniques. Therefore, it suggested that a new Task Force be created under the leadership of Prof. FOEX in collaboration with Prof. KUBASCHEWSKI.
- (iv) *Symposium on Physicochemical Techniques at High Temperatures* (Baden, 3-7 September 1973). The arrangements were discussed and settled, and the moderators were named. A report of the results relevant for the further work of the Commission would be made by Prof. ALCOCK and sent to the Members. Members of the Commission who would be present at the Symposium would contribute to this report.
- (v) *Hot Corrosion*. Prof. FITZER would continue to inform the Commission of new developments. International cooperation and exchange of information would be necessary to further progress in this complex matter.
- (vi) *Silicon Nitride*. A written report by Dr. B. C. H. STEELE was submitted. The Commission agreed with its conclusion that there was little point in studying pure Si_3N_4 because it could not be made industrially. On the other hand, the Si-N-O and the $\text{Si}_3\text{N}_4\text{-Al}_2\text{O}_3$ systems might be worth investigating. The Commission would consider by correspondence how to start a Task Force and get a report.

4. Other Subjects

- (i) *Nomenclature of Defects*. Prof. COLLONGUES commented on Chapter 9 of *Nomenclature of Inorganic Chemistry* and pointed out that in the nomenclature and symbols proposed for defects there would be problems. He mentioned: (a) reintroduction of the name 'berthollides' for all types of nonstoichiometry, (b) the term 'homogeneous' phase, and especially, (c) the symbols e^- and v^+ for electrons and electron-holes

(the symbol 'v' would lead to confusion with ion or atom vacancies). The Inorganic Nomenclature Commission would be asked to reconsider these rules with other specialists, such as structure chemists and high temperature chemists.

- (ii) *Data Flagging*. The principle was endorsed. However, the symbols would have to be checked with care and some eventually changed (such as FE, RC). These views would be conveyed to Prof. D. N. HUME of the *ad hoc* Committee from the Analytical Chemistry Division.

5. Elections

The Commission had received encouragement from the Inorganic Chemistry Division Committee to extend the number of Titular Members to eight (see minutes of previous meetings). As to Titular Members, ALCOCK, FITZER, and RIECK were reelected for four years, and FOEX, HLAVÁČ, KUBUSCHEWSKI, DE MARIA, and STEELE were elected. As new Associate Members were elected: AMATO, GILLES, HORTON, and OHSE. As National Representative for Italy, Prof. R. SERSALE was accepted. Other National Representatives could be suggested by individuals through their National Adhering body.

6. Next Meeting

The Commission was convinced that a meeting in 1974 was necessary because:

- (i) New Members must be thoroughly briefed on the work of Commission.
- (ii) The discussion of the considerable volume of work in progress could not wait for two years.

ORGANIC CHEMISTRY DIVISION COMMITTEE

25-27 August 1973

Present: Prof. G. OURISSON (President), Prof. A. KJAER (Vice-President), Prof. H. ZOLLINGER (Secretary), Prof. V. HEROUT, Prof. M. NAKAJIMA (Members); Dr. K. HEUSLER, Prof. J. MATHIEU, Prof. P. YATES (Coopted Members). For Items 1, 2, 3, and 4 (in part), the following Commission and Section Officers were present: Prof. N. LOZAC'H, Mr. S. P. KLESNEY, Prof. O. L. CHAPMAN, Prof. E. CAMPAIGNE, Dr. A. I. RACHLIN, Prof. E. J. ARIËNS.

I. Membership of Division Committee: 1973-1975

New Officers were proposed as follows: Prof. KJAER (President), Prof. OURISSON (Past-President), Prof. ZOLLINGER (Vice-President), Prof. YATES (Secretary). New Members for 1973-1977 would be: Prof. V. C. BOEKELHEIDE (USA), Prof. S. ITÔ (Japan), and Prof. J. TOMKO (Czechoslovakia). Prof. KJAER would write to ascertain if Dr. H. E. SIMMONS (USA) was willing to cooperate actively with the Division Committee as a Coopted Member.

2. Membership Changes in the Division

All nominations for new Officers and Members in Commissions III.1 and III.3 and in Section III.4 were supported by the Division Committee and would be proposed to the Bureau in Munich.

3. Reports

3.1. *Commission on Nomenclature of Organic Chemistry (III.1).* The Commission had met in Würzburg immediately prior to the Conference in Munich. Earlier it had finalized the manuscript for Section D (P-, B-, Si-compounds) of *Nomenclature of Organic Chemistry* in cooperation with the Inorganic Chemistry Nomenclature Commission (II.2), and it had been published as Tentative Nomenclature Appendix No. 31 (August 1973) to the *Information Bulletin*. A Sub-Committee for sulfur compounds had been formed. Work on logics for computer application and teaching purposes, on cyclophane and spiro compounds, as well as isotopically labelled compounds, had been started. A condensed version of Sections A, B, C and (tentatively D) of *Nomenclature of Organic Chemistry* (the Blue Book) would be made. For Section F (Natural Products) collaboration with laboratories working on natural products would be necessary. The Division Committee suggested for this purpose: J. R. ROWE (USDA Forest Products Laboratories, Madison, Wisconsin), J. MARTEL (Centre de Recherches Roussel Uclaf, Romainville), Prof. R. L. WHISTLER, Prof. Sir DEREK BARTON, Prof. V. PRELOG.

3.2. *Commission on Chemical Taxonomy (III.2).* The Commission had met in Munich. Because the purposes for creation of this Commission had been fulfilled, its dissolution was now proposed. The Division Committee endorsed this proposal.

3.3. *Commission on Organic Photochemistry (III.3).* The Commission proposed to increase its Titular Membership from four to six. It supported a proposal from an *ad hoc* Committee of the Analytical Chemistry Division for a flagging procedure of physical constants (2-letter keywords at the end of scientific papers) and suggested for consideration also the flagging of

types of reaction in a similar way. The Commission was working on recommendations for more accurate descriptions of filters. It discussed 'Photochemistry in Synthesis' and 'Photochemistry in Chemical Education' as potential subjects for symposia.

3.4. *Section on Medicinal Chemistry (III.4)*. The Section had discussed publishing policies for its Newsletter and a report on the education of medicinal chemists. A subcommittee continued to discuss symposia for this field and the Section had made specific suggestions for subjects to be treated at the XXV IUPAC Congress (Jerusalem, 1975).

4. Symposia

4.1. *General*. The general policy of the Division with respect to IUPAC Symposia was reconfirmed: Symposia were considered a major activity of the Division. Three series of main symposia were to be held biennially (Natural Products, Physical Organic Chemistry, Synthesis); there would also be sponsorship of additional symposia in areas of major interest and/or recent scientific developments. No plenary speakers should be invited for three consecutive symposia of the same series.

4.2. *Symposia on Natural Products*. An application from New Zealand to organize the X Symposium (1976) was supported by the Division Committee.

4.3. *Conferences on Organic Synthesis*. The new Division President would see that the place and time of the II Conference (1976) was known before the I Conference in Louvain (1974). Because the Louvain meeting would be the first of the series, definite approval (by correspondence) for continuation of this series would be made probably only after its conclusion. Prof. BOEKELHEIDE would be asked if the 1976 Conference could take place in USA.

4.4. *Conferences on Physical Organic Chemistry*. The formal application to hold the III Conference (1976) in Montpellier and the letter of Prof. G. LAMATY on the specific subject (investigations on carbonyl groups) were discussed and approved. Prof. SUNKO was interested in organizing the 1978 Symposium in Yugoslavia. No recommendation was made by the Division.

4.5. *Symposia on Carbohydrate Chemistry*. The VIII Symposium, to be held in Kyoto in 1976, was approved. Prof. NAKAJIMA would investigate if the Organizing Committee could be based on a larger number of responsible persons due to the imminent retirement of Prof. K. ONODERA.

4.6. *Symposia on Photochemistry*. The V Symposium was approved for Enschede in 1974. The advantages and disadvantages of having IUPAC symposia of the same series twice (or more often) at the same place would be investigated in Enschede and discussed by Commission III.3 and afterwards by the Division Committee.

4.7. *Symposia on Medicinal Chemistry*. No official request had been made yet in respect of the V Symposium for Paris in 1976. Prof. MATHIEU was asked to discuss with the organizers and with Section III.4 if this series could be changed to odd years. Because medicinal chemistry would be one of the major topics at the XXV IUPAC Congress (1975), the Paris Symposium should be postponed to 1977.

4.8. *Symposia on Carotenoids*. The application for the IV Symposium to be in Bern in 1975 was approved with the restriction that the number of plenary lectures should be reduced to 10-15.

4.9. *Symposia on Nonbenzenoid Aromatic Compounds*. The II Symposium would be in Lindau during 1974.

4.10 *Symposia on Stereochemistry*. A preliminary proposal for Kingston, Ontario, in 1976 was discussed briefly and, in principle, supported. Further action would be taken by Prof. KJAER.

5. Finance

The budget of the Organic Chemistry Division for 1974 (as of 31 July 1973) was approved. Subventions and/or deficit guarantees for the following symposia were envisaged: IX Natural Products (\$1,000), I Organic Synthesis (\$1,000), II Physical Organic Chemistry (\$2,000), II Nonbenzenoid Aromatic Compounds (\$1,000).

6. Proposal for Commission on Physical Organic Chemistry

The International Committee for the I IUPAC Conference on Physical Organic Chemistry (Crans-sur-Sierre, 1972) made a proposal for the formation of a IUPAC Commission on Physical Organic Chemistry. The Bureau had appointed an *ad hoc* Committee (Profs. V. GOLD, G. WILKE, and H. ZOLLINGER) to evaluate the proposal and to report to the Organic Chemistry Division and to the Bureau at the Munich Conference.

The Division Committee discussed the report of 20 July 1973 of the *ad hoc* Committee and supported it. As proposed in that report, the Commission should be formed initially for four years; it would try to handle business as much as possible by correspondence only. Because no candidates for Membership of the proposed Commission had yet been asked if they were willing to cooperate on such a basis, it was suggested that Prof. ZOLLINGER become Chairman and that he contact five-seven potential candidates as Titular Members in the near future. The final list of Members would have to be endorsed by the Division Committee and the Bureau.

7. Miscellaneous Matters

7.1. *IUPAC-IUB Commission on Biochemical Nomenclature (CBN)*. Prof. HOFFMANN-OSTENHOF (IUB) asked for reelection of Dr. W. E. COHN and Prof. W. KLYNE as representatives of IUPAC in the Commission for two more years, they having completed eight consecutive years of Titular Membership. The Division Committee would support this request to the Bureau.

7.2. *Sub-Commission on Mass Spectroscopy (I.5.3)*. Prof. KJAER suggested Dr. R. H. SHAPIRO (Boulder, Colorado) as a Member. This was approved and should be conveyed to the Sub-Commission.

7.3. *Financing of IUPAC Symposia*. The Division Committee supported the proposal of Prof. ZOLLINGER to the Treasurer (15 August 1973) with slight amendment. The proposal reads, therefore, as follows:

'Positive balances of IUPAC sponsored symposia can be forwarded to the next symposium of the same series if that symposium is approved by IUPAC. In all other cases, the balances have to be returned to the donators.'

7.4. *International Association of Geochemistry and Cosmochemistry*. An application had been submitted for Associate Organization status of the Union. Cooperation with the Organic Chemistry Division would be welcome.

7.5. *Report of Organic Chemistry Division to Council*. The report prepared by Prof. OURISSON was approved.

COMMISSION ON CHEMICAL TAXONOMY (III.2)

27 August 1973

Present: Prof. A. KJAER (Chairman), Prof. T. J. MABRY (Secretary), Dr. J. B. HARBORNE, Dr. S. NATORI, Prof. G. OURISSON, Dr. T. SWAIN (Titular Members); Prof. W. F. GRANT, Prof. B. L. TURNER (Associate Members); Dr. J. MEARS, Dr. C. SCHÄFER (Observers).

I. Chairman's Report and Comments by Members

The Chairman noted that most of the aims of the Commission had been achieved and that the Commission would, therefore, request dissolution after the present meeting. Also, he noted that the Commission had been successful in organizing an international symposium in Strasbourg (July 1972) on 'Chemistry in Evolution and Systematics' and that the papers from the programme had been published subsequently both in *Pure and Applied Chemistry* and in book form. The Commission had maintained an International Newsletter which would be continued under the editorship of Dr. MEARS. Prof. KJAER said that the Commission had pursued the need for some means of rapidly publishing new reports of natural products with their plant sources. Several publications were discussed, including *Kariyone Index* for which Dr. NATORI reported that there had been some reorganization in connection with the publishing of the Index and that Hirokawa Publishing Co. now had the following publishing timetable:

Volume for 1966	September, 1973
Volume for 1967	December, 1973
Volume for 1968	September, 1974
Volume for 1972	September, 1974
Volume for 1971	December, 1974
Volume for 1973	September, 1975
Volume for 1970	December, 1975
Volume for 1974	September, 1976

The Volumes for 1963 and 1969 would be published as soon as possible once the manuscripts were prepared. Dr. NATORI noted that in the past a major problem for the publisher had been that only about 600 copies of each volume were sold; it was hoped that this number could be increased substantially.

Other publications which reported phytochemical data were: *Pharmacognosy Titles* (Ed. Prof. N. FARNSWORTH); the excellent volumes edited by Prof. R. HEGNAUER, which unfortunately were not expected to continue beyond the additional two or three volumes already projected; the Scott-Devon Index of natural products, which was of little value to botanists or chemists interested in botanical classifications because plant sources were not noted; the journals *Phytochemistry* and *Biochemical Systematics*.

Prof. OURISSON emphasized that there was still no easy way to conduct a systematic search for compounds which had been reported from a particular taxon or the distribution of a particular compound which occurred in many taxa. Dr. SWAIN pointed out that some search services were available at a price. Prof. OURISSON noted that search services which he had used had proved inadequate. Prof. MABRY reminded Commission Members that upon request Prof. FARNSWORTH would provide an academic scientist with a reasonably good phytochemical search for both chemical studies for a taxon and the

distribution of a compound. Dr. MEARS mentioned that *Biological Abstracts* did not list all generic names in an article if more than three or four were recorded.

Both Prof. KJAER and Dr. SWAIN emphasized the need for a 'flagging' system in articles whereby key words could be readily indexed. Dr. SCHÄFER reported that funds might be available from UNESCO to support a data documentation programme for phytochemical data, based in part on the need for such information for developing countries, because phytochemical products represented a major national resource for many underdeveloped countries. Also, he mentioned that active programmes were already underway for other fields, including one devoted to abstracting and recording all solubility data. Such programmes involved information analysis, regional input centres, and regional documentation centres.

Prof. KJAER asked the Commission to express its concern over the proliferation in the literature of trivial names for natural products. Editors of journals should be urged to reject new trivial names. Prof. MABRY suggested that a Member of the IUPAC Commission on Nomenclature of Organic Chemistry should be added to the new International *ad hoc* Committee on Chemotaxonomy (see Item 2) and requested that Prof. KJAER contact the appropriate IUPAC officials in connection with this request.

2. International *ad hoc* Committee on Chemotaxonomy

The Commission noted a report from Dr. MEARS, Acting Chairman-Secretary, on the activities of the new *ad hoc* Committee. It was presently functioning outside the auspices of any organization, including IUPAC. Dr. SCHÄFER suggested that the new Committee might wish later to apply for nonfinancial sponsorship as a body under the auspices of IUPAC.

3. Miscellaneous Matters

- (i) Prof. KJAER opened discussion on the matter of a yearly *Biochemical Systematics Reports* publication, in which one investigator would review the past year's work on a single topic. Dr. SWAIN agreed that this was an excellent idea. Prof. KJAER suggested that the UK Chemical Society might handle the yearly collection of reviewed topics as special publications; not all subjects would be reviewed each year.
- (ii) Dr. HARBORNE had requested earlier in writing that the Commission express its view with regard to the value of *Phytochemistry* continuing to publish 'Phytochemical Reports', because a large number of the Reports were of a trivial nature. In the meantime, the editors of *Phytochemistry* (Dr. SWAIN and Dr. HARBORNE) had initiated more vigorous requirements for a 'Phytochemical Report', *i.e.*, no longer would reports of well known compounds in plants which were expected to contain them be accepted for publication in *Phytochemistry*. The editor of *Lloydia*, Prof. SCHWARTING, had informed Dr. SWAIN that they could not publish phytochemical reports in *Lloydia* but urged that *Phytochemistry* continue to publish them. With stricter requirements, *Phytochemistry* would for the present continue to publish the reports, perhaps with a two-letter code as recommended by Prof. OURISSON; the reports would still emphasize the novelty and importance of the finding.
- (iii) Dr. SWAIN asked the Commission to express its concern with regard to the high cost (\$27.00) for the 320-page book version of the symposium

papers on *Chemistry in Evolution and Systematics* published by Butterworths, especially because they had appeared first in *Pure and Applied Chemistry* and publishing the book from the journal was a relatively inexpensive matter. Dr. SWAIN felt that the explanations provided by the IUPAC Publications Committee were inadequate. Prof. OURISSON, a Member of the latter Committee, agreed to inform the Committee of the Commission's concern.

COMMISSION ON ORGANIC PHOTOCHEMISTRY (III.3)

23-26 August 1973

Present: Prof. O. L. CHAPMAN (Chairman), Prof. K. SCHAFFNER (Secretary), Prof. G. HOYTINK, Prof. G. QUINKERT (Titular Members); Prof. A. M. OSMAN (Observer).

1. It was recommended that the Commission be expanded from four to six Titular Members, and that the new positions be filled by Dr. A. A. LAMOLA (USA) and Prof. T. MUKAI (Japan). Also, it was requested that the Titular Membership of Profs. HOYTINK and QUINKERT be extended for a second term of four years to provide continuity in the early period of the Commission. This was essential to overcome the unfortunate events associated with the birth of the Commission.

2. The V International Symposium on Photochemistry, scheduled for Enschede in July 1974, was discussed. IUPAC sponsorship of the meeting was recommended. The previous four symposia in this series had all been supported by the Union.

3. The proposal of the Analytical Chemistry Division *ad hoc* Committee concerning 'flagging' of physical data was considered at length. The Commission recommended that the proposal be given broader scope to include chemical and physical data. The indexing function of the proposal was the most important feature. It would be most unfortunate if organic chemists were not involved in the formulation of any changes in literature indexing.

4. Action was initiated to improve the reporting of photochemical data with respect to filters, lamp emission, and quantum yields.

5. Action was initiated on a proposal to define a coherent system of excited state symbols. A joint meeting to explore this proposal was held in Munich with the Commission on Physicochemical Symbols, Terminology, and Units (I.1) and the Commission on Molecular Structure and Spectroscopy (I.5).

6. Preliminary action was taken on symposia (or joint symposia) on 'Photochemistry in Synthesis' and 'Photochemistry in Chemical Education'.

7. The Commission planned to meet without expense to IUPAC in Enschede during 1974.

SECTION ON MEDICINAL CHEMISTRY (III.4)

23–25 August 1973

Present: Prof. E. CAMPAIGNE (Chairman), Dr. A. I. RACHLIN (Secretary), Prof. A. ALBERT, Prof. E. J. ARIËNS, Dr. M. PROTIVA, Prof. P. SENSI (Titular Members); Prof. Y. BAN, Dr. J. F. CAVALLA, Dr. L. G. HUMBER, Prof. E. MUTSCHLER, Dr. J. THUILLIER (Associate Members); Prof. W. TH. NAUTA, Prof. S. SAREL, Prof. E. E. SMISSMAN (Observers).

I. Minutes of Previous Meeting

The minutes of the meeting held in Milan on 11–12 September 1972 [see *Inf. Bull.* No. 44 (December 1972), pages 63–67] were accepted.

2. Reports of Officers

2.1. *Chairman.* Prof. CAMPAIGNE reviewed the history of the Section since its inception in 1969 at Cortina d'Ampezzo. He referred to activities of the Section as reported in the minutes of the meetings, which had been held annually, and in the reports of the *ad hoc* Committees on Patent Practices (now disbanded), Education, and Symposia and Meetings. He noted particularly the Section Newsletter which had been singularly successful and closed by informing the Members of the financial problems facing IUPAC.

2.2. *Secretary.* Dr. RACHLIN reported that only one new Correspondent (Republic of South Africa) had been added during the past year and that Africa and Latin America continued to be the weak spots in the network. The Newsletter continued to be successful. Currently 178 copies were distributed to primary sources. Recipients were urged to duplicate and distribute copies regionally. An effort would be made to estimate the actual total distribution. Dr. RACHLIN requested more input from the Members and suggested that a plateau had been reached with the present method of operation. Some thought must be given to means of assuring further progress. In reaction to a suggestion that future issues should carry concise reports of the highlights of recent national meetings, the Secretary would ask for such information in the next request for news items.

3. Problems Submitted to Chairman

3.1. *Endorsement of Nominees for Awards.* In response to a request that the Section should endorse a specific nominee for an award, the Membership had voted not to become involved in such nominations but, if requested by the awarding body for an opinion, it could be given provided IUPAC regulations were not violated. Prof. CAMPAIGNE would contact the necessary IUPAC authorities for information on this point.

3.2. *Flagging System for Abstracts.* An Analytical Chemistry Division *ad hoc* Committee had proposed attaching a flagging system to abstracts and had raised the question of the feasibility of carrying out this proposal on an interdisciplinary basis. After considerable discussion it was agreed that if and when the proposal was approved, the Section would take any necessary action if approached.

3.3. *Justification of Support of IUPAC by Nations.* The general question of IUPAC organization and operation precipitated a discussion of positive contributions by a group such as the Medicinal Chemistry Section. It was

pointed out that the Section could perform important services by organizing symposia in areas such as pollution, particularly internal pollution caused by ingestion of and contact with toxic substances. Also, it could use this means to educate the public to the question of safety of drugs and the rational aspects of toxicity. It was suggested further that the Members should convey these thoughts to the various national adhering bodies. In response to a questionnaire which was to be evaluated eventually by the Executive Committee, the Members drew up a list of foundations which might be approached by IUPAC for the support of special projects.

3.4. *Special Meeting called by Prof. Bénard.* Prof. CAMPAIGNE was given several suggestions for presentation at the Open Meeting on IUPAC Activities in Munich. It was emphasized that the Medicinal Chemistry Section was a good example of a fusion of industry and academia with respect to Membership, interests, and activities. Prof. CAMPAIGNE was urged to cite this experience which could be emulated by IUPAC in the future.

4. Section Finances

Prof. CAMPAIGNE explained, as he had on other occasions, that the Section was financed from the Organic Chemistry Division budget. Its input was made in the form of a two-year proposal by the Division Committee. It was emphasized that very little IUPAC financial support was available for symposia and any such projects sponsored by the Section should be self-supporting. Funds would be requested in the current biennial budget to support a Section meeting to coincide with the IV International Symposium on Medicinal Chemistry (Noordwijkerhout, 9–13 September 1974).

5. Report of ad hoc Education Committee

Prof. SMISSMAN presented the report of the *ad hoc* Committee on Education and the text was discussed in great detail. It was amended to reflect a more positive approach. Final agreement was reached and the report was accepted. Prof. SMISSMAN would prepare the final manuscript for publication and Prof. CAMPAIGNE would handle the details with the relevant IUPAC authorities. The report represented a great effort by the contributors and especially by Prof. SMISSMAN, who was given an enthusiastic vote of thanks.

6. Reports on Meetings and Symposia

6.1. *Ad hoc Committee Report.* Prof. ARIËNS reported on some of the symposia with which the Section had been involved. The Section had adopted the suggestion of the European Federation of Medicinal Chemistry that they sponsor international meetings regularly in even-numbered years in order not to interfere with the biennial IUPAC Congresses, which might or might not have full programmes on medicinal chemistry. Thus, the fourth symposium in the series would be held in 1974 in the Netherlands. Société de Chimie Thérapeutique had proposed having the fifth symposium in Paris in 1976, and the Society for Drug Research had indicated an interest in having the sixth in London in 1978. It was emphasized that all of these symposia were to be self-supporting and were to be cosponsored by the Section, but would require no IUPAC funds. On the negative side, Prof. ARIËNS reported failure in the attempts to cosponsor a symposium with IUB at its IX Congress in Stockholm (1973) and lack of response from the American Chemical Society for a collaborative effort at one of its biennial sym-

posia. Prof. CAMPAIGNE pointed out that ACS planned its meetings far in advance and he would investigate the possibility of a future joint venture. Also, Prof. ARIËNS reported that there was no followup on Prof. YAKOVLEV's suggestion for a meeting in USSR on 'drug design'. As a final note, Prof. ARIËNS, in emphasizing the difficulties of operating this particular *ad hoc* Committee at long range and with too many Members, recommended that it be restructured into a Committee of two Members in close geographical proximity to each other.

6.2. *Preliminary Report on IV International Symposium on Medicinal Chemistry.* Prof. NAUTA reported that 4,000 copies of the first circular had been distributed and 125 responses were received after one week. Accommodation was available for 450 participants. Eleven of the thirteen invited speakers had accepted. The financial support was satisfactory and plans were proceeding on schedule.

6.3. *Preliminary Report on IX Symposium on Natural Products (Ottawa, 1974).* Dr. HUMBER reported that plans were well advanced and issuance of the first circular by IUPAC was expected shortly. The programme would consist of six varied topics and speakers in each area had been selected.

6.4. *Preliminary Report on Symposium on Medicinal Chemistry at XXV IUPAC Congress (Israel, 1975).* A symposium on medicinal chemistry would be one of the five major symposia to be held during the Congress and would last 2-3 days. Prof. SAREL said that it was fully budgeted and plans were approaching an advanced stage. The nine provisional topics were discussed by the Section and several suggested changes were proposed together with appropriate participants. These suggestions would be given serious consideration by the organizers.

6.5. *Proposed Pyrimidine-Fused Pyrimidine Symposium.* Dr. RACHLIN reported on the ill-fated attempts to organize a symposium on pyrimidines and fused pyrimidines in USA. This project had been postponed indefinitely because of failure to obtain funding from NIH despite the efforts of Prof. J. MCCORMACK (University of Vermont). Prof. MCCORMACK was accorded a unanimous vote of thanks by the Section in appreciation of his devotion to this task.

6.6. *New Suggestions.* It was decided to insert a request for suggested symposium topics in the Newsletter.

7. Election of Members

The results of the postal election conducted by the Secretary were announced as follows:

(i) *Titular Members.* Prof. E. J. ARIËNS, Chairman (Netherlands: 1973-1977), Dr. A. I. RACHLIN, Secretary (USA: 1973-1977), Prof. A. ALBERT (Australia: 1973-1975), Prof. E. CAMPAIGNE (USA: 1973-1975), Prof. P. SENSI (Italy: 1973-1975), Dr. L. HUMBER (Canada: 1973-1977), Dr. J. THUILLIER (France: 1973-1977).

(ii) *Associate Members.* Prof. Y. BAN (Japan), Dr. B. BLOOM (USA), Dr. J. F. CAVALLA (UK), Dr. F. MARTIN (Belgium), Prof. E. MUTSCHLER (Germany), Dr. NITA ANAND (India), Prof. P. PRATESI (Italy), Prof. S. SAREL (Israel).

8. New Business

8.1. *International Pharmacopoeia.* Prof. ALBERT reported that this Pharma-

copeia, entitled *Specifications for the Quality Control of Pharmaceutical Preparations*, aimed to give reliable and meaningful standards for about 600 commonly used drugs. Any country without a current pharmacopoeia was invited to use it, or parts of it, to control the quality of its prescribed medicines. After some discussion it was resolved that, although this was not one of its major interests, the Section should support it whenever possible.

8.2. *Problems of New Drugs* [WHO Chronicle 26 (11), 503–510 (1972)]. This WHO report, which was a statement resulting from several previous WHO publications, was discussed at length after an introduction by Prof. ALBERT, because of the many important areas which were covered. Among them were evaluation of drug safety, pharmaceutical quality control, education of the individual practitioner, problems of long term toxicity (including metabolites), nonequivalence of generic preparations in many instances, the need to do more clinical pharmacology, etc. It was agreed that this was a most important publication which should be widely publicized.

8.3. *Problems of Internal Pollution*. This discussion, led by Dr. RACHLIN and Prof. ARIËNS, was prompted by a published report of a meeting of leading European scientists, who had met in Bellagio in May 1973 to consider the problem; Prof. ARIËNS had attended the meeting. The outcome was agreement to develop biological models to study how chemicals affected the human body when it was exposed to them. If meaningful tests which can evaluate the risk of longterm toxicity could be developed early, the introduction of new drugs could be facilitated. The Members favoured this action and the progress of this development would be watched with great interest.

8.4. *Patent Problems Arising from Activity Predictions Based on Calculations*. Dr. HUMBER pointed out that disclosure of structures predicted by calculations, such as those used by Prof. C. HANSCH, could have the effect of retarding or even stopping development of potential drug substances. Thus, publication of structure-activity relationships was, in many cases, delayed for fear of making data available to others who might have better computer programmes. Further, patentability of substances which were disclosed by these calculations, but not made and tested, was precluded: this could discourage industrial development of potential drugs. It was voted to appoint an *ad hoc* Committee to study this question and prepare a Section report.

8.5. *Long Range Planning Committee*. Prof. CAMPAIGNE pointed out that the Section had survived its infancy and was now a viable body. He proposed formation of an *ad hoc* Long Range Planning Committee to set direction and aims for future activities. The motion was accepted.

9. New Committee Appointments

Prof. ARIËNS, in his capacity as Chairman-Elect, made the following appointments:

9.1. *Ad hoc Education Committee*. This Committee would continue as presently constituted (Prof. E. E. SMISSMAN, Chairman) until the final report was issued. Prof. CAMPAIGNE would monitor these activities.

9.2. *Ad hoc Long Range Planning Committee*. Prof. ARIËNS (Chairman), Prof. ALBERT, Prof. CAMPAIGNE, Dr. CAVALLA.

9.3. *Ad hoc Symposia and Meetings Committee*. Dr. CAVALLA (Chairman), Prof. MUTSCHLER.

9.4. *Ad hoc Committee to Study Effects of Predictions of Quantitative Structure-Activity Relationships on Patent Problems.* Dr. HUMBER (Chairman), Dr. BLOOM, Dr. PROTIVA, Prof. SENSI.

9.5. *Section Executive Committee.* Prof. ARIËNS, Dr. RACHLIN.

MACROMOLECULAR DIVISION COMMITTEE

22-23 August 1973

Present: Prof. H. BENOÎT (President), Prof. C. G. OVERBERGER (Vice-President), Prof. G. SMETS (Secretary), Prof. E. W. FISCHER, Prof. Y. IWAKURA, Prof. V. A. KABANOV, Prof. D. W. SAUNDERS, Dr. A. J. DE VRIES (Members); Dr. R. W. CAIRNS, Dr. H. CHERDRON, Dr. G. M. KLINE, Sir HARRY MELVILLE (Coopted Members); Prof. C. H. BAMFORD, Prof. A. BJÖRKMAN, Dr. F. ENGEL, Prof. M. MANDEL, Prof. I. M. PANAYOTOV, Prof. A. SILBERBERG (National Representatives); Prof. G. W. BECKER (Representative of IUPAP); Dr. J. W. BARRETT, Dr. K. L. LOENING (Observers).

1. The minutes of the Division Committee Meeting in Washington on 15 July 1971 (see *Comptes Rendus XXVI Conference*, pages 165-168) and the Minutes of the informal meeting in Helsinki during 1972 were approved.

2. Prof. BENOÎT informed the Division Committee of the decision of the Executive Committee that the number of Members of the Division Committee must be reduced from twelve to ten over the next two years. Consequently, Dr. BARRETT (whose term ended in 1972) and Dr. P. COSSEE (who had resigned) would not be replaced.

The status of the Division's Working Parties, which were not strictly in agreement with the Statutes of IUPAC, had nevertheless been accepted by the Bureau and Executive Committee. Therefore, the proposal of creation of new Commissions had been withdrawn for the present.

3. The activities of the Working Party on Molecular Characterization of Commercial Polymers were reported by Prof. BENOÎT. This Working Party had held two meetings (5 November 1971 and 17 November 1972 at the Solvay Research Centre in Brussels). A survey of the different experimental methods which could be used for the determination of molecular weight distribution and long-chain branching in polyethylene (PE) was presented. Gel permeation chromatography coupled with viscometry seemed now to be the best method. It was shown that the use of universal calibration was satisfactory, but that one had to correct for axial spreading in order to obtain good results. At this time, there was a good agreement on MW-viscosity relation for linear PE in trichlorobenzene at 135° and qualitative agreement for the determination of branching. Because one of the participants was able to prepare very narrow fractions of PE, it had been decided to use them for a final standardization of the methods. A quantitative comparison of the results of long-chain branching determination on one given example would be carried out and these results would be discussed at the next meeting.

4. Dr. DE VRIES reported on the Working Party on Structure and Properties of Commercial Polymers. The Working Party was continuing its various collaborative studies aimed at a better understanding of the relationship between molecular structure, basic rheological and mechanical behaviour, and processing and end-use properties of industrially important macromolecular materials. About fifteen laboratories, most of which belonged to industrial research centres, were taking part in these collaborative research programmes. Regular meetings were held in order to discuss the progress reports prepared by the coordinator of each programme. In 1972 and 1973 the following meetings had taken or would take place shortly:

Bollate (Italy), 1-2 May 1972

Lyon (France), 7 September 1972

Frankfurt/Main (Federal Republic of Germany), 26–27 February 1973

Netherley (UK), 7–8 September 1973

At a special session during the International Symposium on Macromolecules (Aberdeen, 10–14 September 1973), two reports from the Working Party would be presented:

‘Collaborative Study of Dynamic, Mechanical and Impact Properties of PVC—Part II’ by J. C. CHAUFFOUREAUX and A. GONZE (Solvay, Brussels)

‘Effect of Molecular Orientation on Mechanical Properties of Polystyrene’ by T. T. JONES (Monsanto, Newport)

The first report had been published recently in *Pure and Applied Chemistry* [35(3), 315 (1973)] and the second report would be submitted for publication in 1974. Two other final reports were in preparation and expected to be ready for presentation at the forthcoming International Symposium on Macromolecules at Madrid (15–20 September 1974):

‘Relationship between Basic Parameters, Melt Rheology, Processing, and End-use Properties of Three Samples of Low Density Polyethylene’ by J. MEISSNER (BASF, Lufwigshafen)

‘Determination of Rheological Properties of PVC’ by J. L. S. WALES (TNO, Delft)

Proposals for new programmes had been discussed extensively during recent meetings of the Working Party. Two programmes of limited scope had been accepted and would start in 1974. A final report on each programme was hoped to be ready within about two years. The objective of the first programme was to find a complete interpretation of the tensile behaviour of PVC, in particular with regard to the influence of molecular relaxation mechanisms, structural defects, and nonisothermal conditions (coordinator: Dr. CHAUFFOUREAUX, Solvay, Brussels). The second programme was concerned with the effect of orientation on the structure and mechanical properties of two-phase polymers (rubber-modified polystyrenes) [Coordinators: Dr. W. RETTING (BASF, Ludwigshafen) and Dr. J. ZELINGER (Technical University, Prague)]. Finally, at the forthcoming meeting of the Working Party in Brussels (21–22 February 1974) a decision would be taken on a new proposal for a collaborative study on the relationship between structure, rheological properties, and mechanical behaviour of tri-block copolymers.

5. Prof. FISCHER proposed the creation of a new Working Party on thermodynamic properties of polymers in the bulk, e.g., heat of fusion, transition phenomena. The proposal was approved unanimously by the Division Committee. Prof. FISCHER would assume the Chairmanship.

6. After broad discussion and in spite of its previous decision, the Division Committee decided to recommend to the Bureau the creation of a new Commission on Polymer Characterization and Properties, for the following reasons:

- (i) The need for coordination of the activities of its three Working Parties. This was now urgent because of the large size of the two older Working Parties (about twenty active Members in each) and the inevitable overlap in working programmes.
- (ii) The need for creation and control of new Working Parties covering specific topics in the general field of characterization and properties of industrially important polymers.

In the first place Titular Membership of the Commission should be limited

to six, made up of the Chairmen of the three Working Parties responsible to the Commission and appointed by the Macromolecular Division and of three other persons to be nominated by the Division Committee. The constitution, activities, and life of the Commission should be revised every two years by the Division Committee and appropriate recommendations made to the Bureau.

7. Dr. LOENING reported on the activities of the Commission on Macromolecular Nomenclature. So far, the work of the Commission had resulted in three publications, all tentative documents issued as Tentative Nomenclature Appendices to the IUPAC *Information Bulletin*:

'List of Abbreviations for Synthetic Polymers and Polymer Materials'—Appendix 12 (February 1971)

'Basic Definitions of Terms Relating to Polymers'—Appendix 13 (February 1971)

'Nomenclature of Regular Single-strand Organic Polymers'—Appendix 29 (November 1972)

Appendix 29, in particular, had been very well received and had been reprinted this year in *Macromolecules* and *Journal of Polymer Science*. Many comments had been received on these tentative recommendations and they had been discussed and evaluated in the last three meetings of the Commission (Washington, 1971; Knokke-Zoute, 1972; and Munich 1973). Final versions of the first two sets of recommendations would be available for publication in 1974 and of the third set in 1975. Other topics on which the Commission was working were:

- (i) stereochemical designations for macromolecules,
- (ii) subsidiary definitions of terms relating to polymers,
- (iii) nomenclature and symbolism of copolymers,
- (iv) definition and nomenclature of ladder polymers,
- (v) nomenclature of inorganic polymers.

Of these, (i) and (ii) were at the most advanced stage, tentative documents being expected to be issued during the next biennium. Through exchange of observers and correspondence the Commission cooperated closely with other Commissions and Committees engaged in nomenclature work of overlapping interest. Among these, ISO/TC 61 (Plastics) and the Commission on Biochemical Nomenclature (CBN) of IUPAC-IUB should be singled out.

Assuming financial support, it was planned that the Commission would meet in Spain during 1974 and it would have an Observer at the CBN meeting to be held immediately before or after the Commission meeting.

8. The list of IUPAC-sponsored general macromolecular symposia was reviewed. The following symposia were considered:

- (i) International Symposium on Macromolecules (Aberdeen, 10–14 September 1973). Dr. BARRETT gave some comments about the division of the lectures between industry and university.
- (ii) International Symposium on Macromolecules (Madrid, 15–20 September 1974).
- (iii) International Symposium on Macromolecules (Jerusalem, 14–19 July 1975). Prof. SILBERBERG gave some information about the topics which would be on the programme. A definite recommendation for IUPAC

sponsorship would be given by an *ad hoc* Committee (BENOÎT, OVERBERGER, CHERDRON, KABANOV), after receipt of more detailed and final information.

- (iv) Prof. IWAKURA invited the Macromolecular Division to have its general symposium in Japan in September 1977. This invitation was gratefully acknowledged.
- (v) Prof. KABANOV intended to organize a meeting in USSR, either in 1976 or in 1978. Similarly, German colleagues were considering the possibility of organizing a symposium in Federal Republic of Germany in 1979.

9. Other macromolecular meetings were reviewed as follows:

- (i) International Symposium on Macromolecules (Rio de Janeiro, 26–31 July 1974)—already approved.
- (ii) XIV IUPAC Microsymposium—Crosslinking and Networks (Prague, 26–29 August 1974)—approved.
- (iii) IV Discussion Conference on Macromolecules—Heterogeneities in Polymers (Marienbad, 2–5 September 1974)—approved.
- (iv) International Symposium on Degradation and Stabilization of Polymers (Brussels, 11–13 September 1974)—considering the fact that this topic was also a general topic of the Madrid Symposium, it was suggested to ask the organizers to postpone the meeting, if possible, for one year.

10. In connection with Items 8 and 9, a broad discussion about the general policy of the Macromolecular Division concerning the sponsorship of meetings was undertaken. An *ad hoc* Working Group was set up (BENOÎT, OVERBERGER, SMETS, KABANOV, SILBERBERG, and CHERDRON) to produce guidelines and recommendations, which could be sent to the scientific and organizing committees of symposia applying for sponsorship of the IUPAC Macromolecular Division.

11. Prof. OVERBERGER informed the Division Committee of the problems of the transfer of the Organic Coatings Section to the Macromolecular Division from the Applied Chemistry Division. It was confirmed during the discussion that the only possibility was to transfer it as a new Working Party, so that the orientation of the activities of this group could be made to conform with the internal rules of the Division. If financial support was needed for this change of orientation, application would be made to the Bureau for a corresponding increase of the Division budget.

12. The report of Prof. SMETS about Education in Polymer Science would be sent to all Members of the Division Committee. It was desirable to provide to Prof. SMETS the addresses of existing national polymer groups.

13. The next meeting of the Division Committee would take place provisionally in Madrid on the occasion of the International Symposium in September 1974.

**Joint Meeting of Macromolecular Division Committee
and Section on Organic Coatings (OCS) of Applied
Chemistry Division**

25 August 1973

Present: Prof. H. BENOÎT, Prof. C. G. OVERBERGER, Prof. G. SMETS, Prof. A. BJÖRKMAN, Prof. Y. IWAKURA, Prof. M. MANDEL, Prof. I. M. PANAYOTOV, Prof. A. SILBERBERG, Dr. A. J. DE VRIES (Macromolecular Division Committee); Mr. P. H. FINK-JENSEN, Mr. A. R. H. TAWN, Dr. U. ZORLL, Mr. G. CHRISTENSEN, Dr. J. A. W. VAN LAAR, Dr. L. A. O'NEILL, Dr. K. M. OESTERLE, Prof. D. PAGANI, Mr. H. K. RAASCHOU NIELSEN, Dr. D. WAPLER, Mr. V. ZVONAR (Section on Organic Coatings).

After opening the session, Prof. BENOÎT invited the Chairman of OCS to describe the past activities of his Section and its plans for the future. Mr. FINK-JENSEN explained that creating background information for the co-ordinated coatings industry, based on both experimental studies and information collection at an international level, had been the main objective of OCS. The Section was active currently in four areas:

- (i) Extensive experimental studies were carried out in the analytical field related to polymeric binders for coatings. Results on alkyd resins had been published recently in *Pure and Applied Chemistry* [33(2-3), 411 (1973)]. Similar work on acrylics and urethanes was virtually finished and being prepared for publication. Extension of the studies on polyamides, as far as they were of importance to organic coatings, had been started. This experimental programme was expected to be continued.
- (ii) In the testing field for organic coatings, a study was being carried out on adhesion of polymeric films on various substrates. Methods of testing and better understanding of the fundamentals of adhesion were to be taken into consideration.
- (iii) According to the increasing need to obtain quick access to the special coatings literature, only partially covered by chemical abstracts, a survey on information retrieval in the field of organic coatings was in preparation. The aim of the work was to establish, within 1-1.5 years, a collection of data from literature sources that facilitated documentation for specialists interested in coatings.
- (iv) In line with the increasing need of specialists in the domain of organic coatings, information was being collected concerning postgraduate education programmes already in existence.

Future proposals of the Section were explained by Mr. TAWN with respect to the tendency of using more and more concentrated polymer solutions as paint materials and in order to meet environmental requirements, the question of polymer-solvent interaction as well as determination of retained solvent was gaining interest. The existing, effective methods for such studies, e.g., radio tracer methods, GPC, should be supplemented by less sophisticated but likewise appropriate procedures. Extension of the studies was planned into such related fields as finding residual monomers and low molecular weight degradation products besides any retained solvent, penetration of solvent and polymers into substrates or other attached materials. Swelling properties of polymers would be considered in relation with thermodynamics of polymer solutions. A second proposal referred to water-based coating

materials. In most cases, these contained a certain amount of organic solvent. Adequate methods for characterizing the state and behaviour of such three-component systems were to be developed. The purpose of the studies was not only to find guidelines for handling such systems in general coatings practice, but also in connection with effluent disposal problems.

After the review of the activities of OCS, Prof. BENOÎT described the organization scheme of the Macromolecular Division in order to prepare for a possible affiliation of OCS. At present, there was one Commission (on Nomenclature) and two Working Parties (Structure and Properties, Polymer Characterization) under supervision of the Division Committee. An application had been made to the Bureau to coordinate the activities of the Working Parties under a new Commission on Polymer Characterization and Properties. Prof. BENOÎT proposed that OCS could be included as Working Party of the Division, either as one under the new Commission or as an independent one, directly responsible to the Division Committee. It was unanimously decided to proceed in the latter way. The name of the new Working Party would be 'Supported Polymer Films' (SPF). In order to ensure good collaboration, Mr. FINK-JENSEN would become a Coopted Member of the Division Committee.

Prof. BENOÎT then explained the rules of the Macromolecular Division in some detail, emphasizing that each Working Party had to report every two years to the Division Committee. Based on this report, voting would be made about its continuation or what else might be adequate of the working programme. Mr. FINK-JENSEN agreed that SPF would adhere to these rules.

Finally, both Prof. BENOÎT and Mr. FINK-JENSEN expressed thanks for the cooperative attitude of all those who were active in bringing about this merger, in particular Prof. BJÖRKMAN, who had taken over a great deal of the preparation. Prof. BENOÎT closed the session with the hope that the integration of OCS into the Macromolecular Division would be of benefit to both bodies.

COMMISSION ON MACROMOLECULAR NOMENCLATURE (IV 1)

25–29 August 1973

Present: Dr. K. L. LOENING (Chairman), Dr. L. C. CROSS (Secretary), Prof. P. CORRADINI, Dr. R. B. FOX, Prof. N. A. PLATÉ, Dr. W. RING, Prof. G. SMETS, Prof. T. TSURUTA (Titular Members); Dr. G. M. KLINE (Observer).

1. Minutes of Previous Meeting

The minutes of the meeting at Knokke-Zoute during 4–9 June 1972 [see *Inf. Bull.* No. 45 (May 1973), pages 20–21] were taken as read: individual items were dealt with as they arose during the present meeting.

2. List of Symbols for Synthetic Polymers and Polymer Materials

Comments received on Tentative Nomenclature Appendix No. 12 (February 1971) to the *Information Bulletin* were considered, particularly the following:

(i) *Use of Enclosing Marks.* Dr. KLINE drew attention to the ISO position, and to the voting by National Adhering Organizations, on use of enclosing marks in source-based names of polymers. The Commission decided that, although it accepted the footnote ISO proposed to add to the ISO/TC 61 document, it would continue to recommend the logical, scientific use of enclosing marks to delineate the portion of the name representing the source molecule.

(ii) It was noted that some of the abbreviations recommended were also used, with quite different meanings, as tradenames (e.g., PAN was a Baeyer European tradename for a fibre). It was agreed that no change would be made in the recommended abbreviation provided there could be no serious confusion.

(iii) The wording “Abbreviations (Symbols)” would be inserted instead of “Symbols” in the title and elsewhere.

(iv) A few minor verbal alterations would be made in the text.

(v) *Action.* Following these changes the document was to be issued to the Secretariat for publication as definitive and the action reported to the Division President.

3. Basic Definitions of Terms Relating to Polymers

Tentative Nomenclature Appendix No. 13 (February 1971) to the *Information Bulletin* was completely reworked in the light of comments received from throughout the world and those made by Members of the Commission. A Drafting Committee was constituted of Prof. TSURUTA (Convenor), Dr. FOX, and Dr. CROSS, with Prof. TSURUTA to coordinate action, to finalize the document, and issue it to the Commission and to the Secretariat.

4. Subsidiary Definitions of Terms relating to Polymers

Consideration of items for a list of subsidiary definitions, begun last year, was continued. It was agreed that Prof. TSURUTA's document (April 1973) should form the basis of a tentative list. Prof. TSURUTA would continue to collect material.

5. Nomenclature of Regular Single-strand Organic Polymers

Publication of these rules as Tentative Nomenclature Appendix No. 29 (November 1972) to the *Information Bulletin* was noted. Consideration was given to letters (dated 12 and 16 July 1973) from Chemical Abstracts Service, listing proposed corrections and changes. Some were related to matters of principle; detailed evaluation of these was therefore postponed until the Commission upgraded the document. A Working Party of Dr. LOENING, Dr. Fox, and Dr. CROSS, was formed to start that work.

6. Stereochemical Nomenclature of Polymers

Study of earlier papers by Prof. CORRADINI and F. A. BOVEY and one from the former dated 25 July 1973 was completed. A Working Party consisting of Prof. CORRADINI, Prof. PLATÉ, Dr. Fox, and Dr. TSURUTA, was formed to create a tentative version of this nomenclature to be published after the 1974 meeting of the Commission.

7. Classification of Polymers by Families

The paper 'Nomenclature of Individual Groups of Polymers according to the Structure of the Main Chain', by V. V. KORSHAK was given general consideration. It was agreed that such a classification might be useful and a Working Party (Profs. PLATÉ and SMETS) agreed to review the literature and bring further suggestions to the next meeting.

8. ASTM Definitions for Polymer Terms

Correspondence from ASTM (Committee D-11.08) dated 12 April 1973, concerning use of simplified terms in the rubber industry, was reviewed. It was agreed that the Commission should create a set of simplified definitions, based on the technical definitions it had already issued.

9. Nomenclature of Naturally-occurring Macromolecules

Tentative rules and recommendations on:

- (i) Abbreviations and Symbols for Description of Conformation of Polypeptide Chains (Tentative Nomenclature Appendix No. 10, February 1971)
 - (ii) Abbreviations and Symbols for Nucleic Acids, Polynucleotides, and their Constituents (Tentative Nomenclature Appendix No. 9, February 1971)
 - (iii) Abbreviated Nomenclature of Synthetic Polypeptides (Polymerized Amino Acids) [*Inf. Bull.* No. 30 (October 1967), page 27]
- promulgated by the IUPAC-IUB Commission on Biochemical Nomenclature (CBN) were noted.

10. Other Future Work

- (i) Nomenclature of Ladder Polymers (Dr. Fox).
- (ii) Nomenclature of Inorganic Polymers (Drs. CROSS and LOENING).
- (iii) Nomenclature and Symbolism for Copolymers (Dr. Fox, Dr. RING, and Prof. SMETS).

II. Administration

(i) *Membership.* No change was yet required in the Titular Membership of the Commission, but a small pool of Associate Members should be created as potential replacements for Titular Members.

(ii) *Next Meeting.* To be for four days, in May-June 1974, in Europe (probably Spain), immediately after the CBN meeting.

ANALYTICAL CHEMISTRY DIVISION COMMITTEE

22 and 26–27 August 1973

Present: Prof. W. KEMULA (President), Prof. N. TANAKA (Vice-President), Mr. R. W. FENNELL (Secretary), Prof. W. FISCHER, Prof. H. FREISER, Prof. I. M. KOLTHOFF, Prof. O. SAMUELSON, Prof. B. TRÉMILLON, Prof. T. S. WEST, Prof. YU. A. ZOLOTOV. *By invitation:* Dr. N. N. CHOPRA, Prof. D. N. HUME.

1. President's Opening Remarks

The President welcomed the Members of the Division Committee and thanked them for the work they had done since the last Conference. He recalled the death of Prof. A. RINGBOM and asked the Members to stand for a moment in remembrance of this former colleague. Prof. KEMULA referred to his biennial report to Council, which showed that the progress and development of the Division was good. He made a special point of the development of cooperation between Commissions within the Division and with those in other Divisions.

2. Minutes of Previous Division Committee Meeting

The minutes of the meeting at Washington (1971), as published in *Comptes Rendus XXVI Conference* (see pages 172–174), were approved.

3. Election of Committee Members

3.1. Report of N/E Committee 1971–73. The Secretary reported, on behalf of the Chairman of the N/E Committee, the results of the election. Those elected were:

Prof. D. N. HUME (USA)

Prof. H. KAISER (Germany)

The Secretary was asked to thank the Members of the N/E Committee for their work.

3.2. Election of N/E Committee 1973–75. The Secretary was given instructions to establish the Membership of the Committee by correspondence.

3.3. Procedure for Election of Vice-President (President-Elect) 1975–77. After some discussion it was agreed that a postal election procedure would be followed, to be completed before 1 September 1974.

4. Division Finances

The expenditure for 1972 and budgets for 1973 and 1974 were noted. It was pointed out that the budget for 1974 was subject to revision and that the disposal of the Contingency Fund for 1973 was in the hands of the Division President. Some of the Contingency Fund had already been used to enable key Members of the Division to attend the Conference in Munich.

5. Sponsorship of Symposia

The list of symposia recommended by the Division for IUPAC sponsorship was noted. Prof. TANAKA placed on record the gratitude of the Japan Society for Analytical Chemistry for the Division's support for the Congress in Kyoto, April 1972.

6. Reports of ad hoc Committees

6.1. *Information Storage and Retrieval*. Prof. TANAKA presented a report from Prof. S. FUJIWARA. It was agreed that Commission V.3 should be asked to consider taking over this subject as a Commission project.

6.2. *Compendium of Analytical Nomenclature*. Profs. FREISER and WEST reported that Commissions V.2, V.3, V.4, and V.5 had agreed to editorship of nomenclature recommendations by a working committee. It was estimated that about 15 sets of recommendations could be included in the first edition. It was agreed that Commission V.3 should be asked to be responsible for this project.

6.3. *Key-coding of Abstracts (Data Flagging)*. Prof. HUME reported on the progress achieved by his *ad hoc* Committee. It had received unexpectedly enthusiastic support from other IUPAC Divisions and from some editors of journals, who had not been approached directly but had heard of the proposals from colleagues. An open meeting of the group had been held on 22 August at which the general feeling was that the project was useful, feasible, and economically sound; it was felt that editors of journals and abstracts would cooperate.

In reply to questions, Prof. HUME replied that in the experimental list produced to date, the flagging letters had been chosen as being suggestive of the class of numerical data contained in a paper. The list could easily be expanded and a digital code used. However, the latter would not be as easily recognizable as a letter code. Although the Interdivisional Committee on Machine Documentation had not been represented at the open meeting, he had been assured that the system was compatible with computer usage. He thought that the project should be explored more thoroughly within IUPAC before comments were invited from outside the Union.

It was agreed that Prof. HUME should prepare a brief report, which the Division President could place before the Bureau, with the recommendation that an Interdivisional Committee be appointed to examine the proposals further and report to the Bureau.

7. Coordination of Activities

7.1. *Trace Analysis*. The President referred to the documents collected by the Secretary on this subject and reproduced in the meeting file. It was pointed out that the problem of coordination of activities on trace analysis within the Division should not be confused with the allied subjects of standard reference materials, environmental analysis, and collaboration with the Applied Chemistry Division. It was the role of Commission V.2 that was under discussion, particularly in relation to the activities of the 'analytical technique' Commissions. The proposal to form a subcommittee to deal with trace problems was discussed, but it was not clear what advantages such a subcommittee would have over normal cooperation between Commissions. It was suggested that Commissions dealing with special techniques should be asked to deal with problems arising within their own fields and that Commission V.2 should deal with other items.

Discussions between representatives of the Analytical and Applied Chemistry Divisions took place during the Conference from which it appeared that there was a requirement for the collection and tabulation of the sensitivities attainable by various trace analytical techniques for the determination of elements. It was agreed that Commission V.2 should be asked to undertake

this project and to invoke specialist assistance from Commissions V.4, V.5, and V.7.

7.2. International Office for Analytical Chemistry. The progress of this IUPAC project up to March 1973 was noted.

7.3. Applied Chemistry Division. It had been agreed at Kyoto that contact between the two Divisions should in the first instance be via the respective Division Secretaries. The Secretary of the Applied Chemistry Division had stated that no new areas of interaction between the Divisions had been suggested by bodies within his Division.

7.4. International Organization for Standardization (ISO). The President welcomed Dr. CHOPRA (ISO Central Secretariat), who was able to be present for the discussion on this item. Dr. CHOPRA gave a brief outline of the functions of ISO which had about 1,400 bodies working on development of standards. The Central Secretariat was at Geneva but the individual Secretariats (Technical Committee and Sub-Committee) were located all over the world. ISO had relations with about 300 other organizations—United Nations, governmental, and nongovernmental—and it was very pleased that collaboration with IUPAC had improved markedly over the past few years. It was now proposed that if IUPAC approval was given to an ISO Standard, an indication to that effect would be incorporated in the Foreword to the International Standard.

ISO proposed that copies of relevant Draft International Standards (DIS) should be sent to IUPAC for examination and approval and/or comment, replies to be sent to ISO within six months. After finalization of the International Standard, the revised text and final report (summary of changes made) is sent for final approval within six weeks if IUPAC approval was conditional on incorporation of changes in the DIS. The Committee expressed some doubt on the latter proposal because the revised text might be different to the DIS, owing to incorporation of amendments proposed by other bodies. It would be essential for the revised text to be forwarded to IUPAC in every case. There was also some doubt as to whether six weeks was long enough to give final approval.

In reply to questions, Dr. CHOPRA said that if there was any difficulty the IUPAC approval could be omitted until, after further study, agreement had been reached. IUPAC approval could then be incorporated in an amendment slip or in the second edition of the International Standard. The ISO central editing service at Geneva checked all Standards against published IUPAC recommendations on nomenclature, terminology, and symbols.

It was agreed that the following mechanism should be set up in the Division. The existing list of experts should be divided into groups, each group having a 'coordinator' who would accept the responsibility of compiling a summary of the experts' comments in a Draft Standard and forwarding it to the IUPAC Secretariat. The coordinator would also act on the Division's behalf in signifying its approval of the ISO revised text if this was in substantial agreement with what had already been agreed by the Division. A system of positive approval would be required. The Bureau would be asked to comment on the proposed mechanism for the conversion of Division approval into IUPAC approval.

8. Standard Reference Materials (SRMs)

The President referred to a letter he had received from Dr. W. W. MEINKE (NBS), requesting that three SRMs produced by NBS should be considered

and endorsed by the Division. Copies of the specifications of these SRMs had been circulated to the Chairmen of Commissions V.2, V.4, V.5, and V.7 and their comments were reproduced in the meeting file, as was an announcement prepared by Commission V.7, proposed for inclusion in the *IUPAC Information Bulletin*, recommending the use of the SRMs for calibration of radioanalytical methods and encouraging further study of these materials by other laboratories. Copies of the up-to-date specifications were distributed to the Division Committee.

The Division Committee complimented NBS for making available three SRMs of great practical importance in the field of trace analysis. However, the Committee agreed that it could not endorse officially these materials, although it approved the announcement proposed by Commission V.7.

On the more general subject of standard reference materials, the Secretary was instructed to ask Commission V.1 to consider the possibility of that Commission compiling a list of the distributors of SRMs and the types of material available other than those for trace analysis which were already under study by Commission V.2.

9. Programme of Commissions

9.1. *Progress 1971–73.* The President said that the biennial reports on progress provided by the Commissions were reproduced in the meeting file for information. The Secretary apologised for the short time allowed for the Committee to comment on four finalized nomenclature reports from Commission V.3. These had been received too late for the normal period allowed, but had to be approved by the Division before the Council meeting in Munich. He had passed the comments received to the Commission which had accepted them. The President authorized these reports to be submitted for approval by Council.

Two nomenclature reports from Commission V.4 had been finalized at the Conference and Division Committee approval was sought. The Committee was unable to approve one of these reports because there was no opportunity to consider the revisions in detail in the time available.

The Secretary was instructed to write to Commission Chairmen reminding them of the standard procedure for approval of reports, as detailed in the Division Rules, and particularly of the time schedule necessary for nomenclature reports, and to ask them if they would attach to a report a list of referees to whom a draft had been sent before submission for Division Committee approval.

9.2. *Programme and Personnel 1973–75.* The proposals of the Commissions for 1973–75, as given in their Conference Reports, were considered in the presence of all Commission Chairmen. The proposals were agreed with the following provisos:

- (i) Commission V.1—The proposed project on expression of results in colorimetric and fluorimetric analysis by chemical methods should be subject to collaboration with Commissions V.3 and V.4.
- (ii) Commission V.2—It was finally considered inexpedient to request an additional Titular Member for the Commission.
- (iii) Commission V.3—The projects concerned with selective ion electrodes should be subject to collaboration with Commission V.5.
- (iv) Commission V.4—Reference should be made to Commission V.3 to ensure that there was no overlap on projects on nomenclature of ana-

lytical molecular fluorescence spectroscopy and analytical molecular absorption spectroscopy.

- (v) Commission V.7—Liaison with Commission VI.1.2 should be maintained on the projects concerned with nuclear methods for the analysis of key elements in environmental pollution. The proposed project on solvent extraction separations in radioanalytical chemistry should be referred to Commission V.6 to ensure that there was no overlap.

10. Matters Arising from Division Open Meeting

10.1. *Harmonization of Collaborative Analytical Studies.* The Committee agreed that Dr. EGAN's proposal, to try to call a meeting of organizations carrying out collaborative exercises on analytical methods, was a good one. However, whilst it was very willing to maintain an interest in the matter, the Committee did not feel that the Analytical Chemistry Division should take over the project, which was far more in the field of the Applied Chemistry Division.

10.2. *Revision of Statutes.* It was agreed that the President should raise the question of the formation of an *ad hoc* Committee, of representatives of all Divisions, at the Division President's meeting.

11. Any Other Business

11.1. *Division of Nuclear and Radiochemistry.* The President referred to a proposal that a new Division of Nuclear and Radiochemistry should be formed within IUPAC. It was agreed that the Division Committee could not support this proposal.

11.2. *Pollution and Environmental Analysis.* There had been a number of proposals that the Division should concern itself with methods of environmental analysis. It was pointed out that the Applied Chemistry Division was increasingly concerning itself with this subject, notably through its Food, Pesticides, Air Quality, and Water Quality Sections. In addition, the President of IUPAC had suggested that SCOPE could well be presenting problems to the Division in the near future. It was agreed therefore that, although the Division would welcome requests for assistance from Division VI or SCOPE, no Division programme should be initiated at the moment. It was suggested, however, that the programme of the Division should be sent, via the IUPAC Secretariat, to SCOPE for information.

11.3. *Guidelines for Instrumental Analysis Courses.* The President referred to a letter he had received suggesting that the Division Committee should undertake the development of guidelines (or of a manual) for instrumental analysis courses. It was agreed that the proposal should be forwarded for consideration by the IUPAC Committee on Teaching of Chemistry.

12. Concluding Addresses

The President, Prof. KEMULA, thanked the Division Secretary and other Members of the Division Committee—and the Division as a whole—for their hard work and support during his term of office. He was confident that the Division had been growing in stature all the time and that it would continue to do so under his successor, Prof. TANAKA.

Prof. TANAKA said that it would be a great honour and pleasure to serve as Division President and he was very conscious of the heavy responsibility

he was taking over. He was sure that the Division fully appreciated the work done by Prof. KEMULA and was glad that he would still be available, as Past-President, for advice and support. He also expressed his appreciation of Mr. FENNELL's work as Division Secretary and his pleasure at having Mr. FENNELL to work with on assuming the Presidency.

COMMISSION ON ANALYTICAL REACTIONS AND REAGENTS (V.I)

23–24 August 1973

Present: Prof. R. BELCHER (Chairman), Prof. F. PELLERIN (Secretary), Dr. J. BARTOS, Dr. A. HULANICKI, Dr. M. KAPEL, Mr. F. J. REIDINGER, Prof. S. SIGGIA, Prof. H. WEISZ (Titular Members); Prof. G. DUYCKAERTS, Dr. M. HARMELIN, Prof. S. IKEDA, Prof. J. INCZÉDY, Dr. M. PESEZ (Associate Members); Dr. W. I. STEPHEN (Observer).

1. Minutes of Previous Meeting

The minutes of the meeting held in Paris on 8 May 1972 [see *Inf. Bull.* No. 44 (December 1972), pages 34–37] were approved.

2. Membership

The Commission proposed to extend the Titular Memberships of Dr. HULANICKI and Mr. REIDINGER for a second term of four years. Prof. F. LUCENA CONDE (Spain) and Dr. W. I. STEPHEN (UK) were nominated as new Associate Members to replace Prof. P. PAPOFF and Prof. L. SOMMER, whose term of office had ended.

3. Report on Phenols

The report 'A Survey of Some Recommended Methods for Identification and Determination of the Phenol Group' had been published as Technical Report Appendix No. 7 (August 1973) to the IUPAC *Information Bulletin*.

4. Amine Groups

The report 'A Survey of Some Recommended Methods for Identification of Amine Groups', prepared by Dr. BARTOS, Prof. PELLERIN, Dr. PESEZ, and Prof. SIGGIA, was approved. Prof. BELCHER would forward this report to the Analytical Chemistry Division Committee. After dealing with any comments arising therefrom, the Commission would then send it for publication by IUPAC.

5. Redox Indicators

The first draft by Dr. HULANICKI was discussed and he was asked to continue this work. A revised draft would be studied for finalization at the next meeting.

6. Other Projects under Study

Drs. PESEZ and BARTOS presented a report on 'Identification and Determination of Carbonyl Groups'. Commission Members would send their comments direct to Dr. BARTOS. The amended report would be studied at the next meeting. Prof. SIGGIA would prepare a supplement.

The following subjects were also being studied:

- (i) colorimetry and fluorimetry of steroids (Drs. PESEZ and BARTOS)
- (ii) complexometric indicators (Dr. HULANICKI)
- (iii) acid-base indicators in nonaqueous solvents (Prof. PELLERIN)

(iv) Identification and determination of polyphenols (Prof. PELLERIN, Drs. BARTOS and PESEZ).

These studies would all be reviewed at the next meeting.

7. Relations between IUPAC-ISO and Commission V.1

Members of Commission V.1 had been receiving, for comment from ISO, a large number of draft International Standards whose relevance was not always within their competence. They wished to continue their cooperation, but felt that IUPAC should organize specialized groups of Members for various types of analytical method. A liaison group could supervise this organization.

8. 1973 IUPAC-CEE Contract

Prof. PELLERIN gave an account of the work concerning the IUPAC-CEE Contract for 1973. His report was adopted. Four methods required further information from CEE. Two methods had been withdrawn because they required further study by IUPAC. Nine methods could be adopted and sent to CEE. Their despatch was subject to the corrections which had been presented for each of them. Dr. KAPEL and Prof. PELLERIN, together with Dr. COLLINGS, would prepare a definitive text which would be sent to Prof. TRUHAUT and Dr. EGAN at the end of September 1973.

9. Standard Substances

The problem of standard substances was discussed by the Commission. Prof. PELLERIN believed there had been some confusion between the terms 'standard substances' and 'reference substances'. It was IUPAC's responsibility to make suggestions in the field of standard substances. Commission V.1 would participate in this work and study any suggested standards which were presented to them.

10. Any Other Business

From the study of methods for identification and determination of functional groups by chemical reaction, Dr. BARTOS indicated that, in his experience, the means of expressing the results were very variable. Some uniformity of presentation appeared to be necessary. It was decided that the expression of results of spectrophotometric and fluorimetric determinations would be studied. Comments and suggestions should be sent to Dr. BARTOS, who would prepare a detailed report for the next meeting.

11. Next Meeting

Commission V.1 proposed to meet in Paris on 7 May 1974. Prof. PELLERIN would make the hotel reservations and asked all Members of the Commission to inform him as to their participation at this meeting before 15 March 1974.

COMMISSION ON MICROCHEMICAL TECHNIQUES AND TRACE ANALYSIS (V.2)

23–23 August 1973

Present: Dr. O. G. KOCH (Chairman), Dr. M. PÍNTA (Secretary), Prof. K. L. CHENG, Dr. N. E. GEL'MAN, Prof. S. GOMIŠČEK, Dr. A. M. G. MACDONALD, Prof. G. H. MORRISON (Titular Members).

1. Minutes of Previous Meeting

The minutes of the meeting in Washington, DC, during 17–18 July 1971, had been published in *Comptes Rendus XXVI Conference* (pages 177–179).

2. Reports

The following reports had been published or were in course of publication:

- (i) 'Erreurs en Microanalyse Organique Elementaire. Parts 1–3' (R. LEVY), *Pure Appl. Chem.* **29**, 411, 629; **30**, 301 (1972).
- (ii) 'Study on Purification of Chemicals for Trace Analysis' (O. G. KOCH), *IUPAC Information Bulletin* Nos. 42/43 (July 1972), page 23.
- (iii) 'Trace Analysis Applicable to Determination of Minor Impurities in Chemicals—I: General Survey (M. PÍNTA), *Pure Appl. Chem.* (1974, in press).

The following report had been submitted to the Analytical Chemistry Division Committee for final approval: 'Trace Analysis Applicable to Determination of Minor Impurities in Chemicals—II: A Study of Trace Impurities in Oxygen and Helium' (K. L. CHENG and G. H. MORRISON).

3. Projects Completed

- (i) 'Study on Accuracy and Precision of Determination of Fluorine in Organic Compounds' (1969–1973—Project leader: MACDONALD).
- (ii) 'Study on Accuracy and Precision of Carbon and Hydrogen Determination in Organic Compounds containing Heteroelements' (1969–1973—Project leader: GEL'MAN).
- (iii) 'General Aspects of Trace Analytical Methods—I: Methods of Calibration in Trace Analysis' (1971–1973—Project leader: MORRISON).
- (iv) 'General Aspects of Trace Analytical Methods—II: Destruction of Organic Matter. Preconcentration of Elements for Trace Analysis' (1971–1973—Project leader: CHENG).
- (v) 'Trace Analysis Applicable to Determination of Minor Impurities in Chemicals—III: Application to High Purity Mineral Acids (1971–1973—Project leader: PÍNTA). This report was in French and would be translated into English.
- (vi) 'A Comparison of Mass Absorption Coefficients given by HEINRICH, THEISEN, VOLLATH, and FRAZER in the Region of $K\alpha$ -Radiation' (1967–1973—Project leaders: MALISSA and GRASSERBAUER; Contributors: HORN, HAMPEL, and PICHLER).
- (vii) 'Expression of Error in Organic Analysis' (1969–1973—Project leader: MACDONALD). The Commission decided that this report should not be published in *Pure and Applied Chemistry*. Therefore, the results of the project are summarized below:

Traditionally, standard practice in organic elemental analysis had been to give absolute limits of error ($\pm 0.3\%$). It was considered initially that such expression no longer had special significance, particularly in the case of automatic analyzers as now commonly used for routine analysis. However, a study of experimental data in the project leader's laboratory, and consultation with various microanalysts, had indicated that the trends in error for automatic methods were very similar to the trends for classical gravimetric techniques. The consensus of opinion was that no benefit was to be gained for routine work by changing the traditional usage of accepting a result within 0.3% absolute of the theoretical value as evidence of purity; or in the case of materials of unknown composition, of accepting results which agreed within 0.3% , as evidence of a true value, in the absence of interferences.

It was, however, recommended that in reporting verification of a new procedure, the data should include proper statements of accuracy, bias, and precision, as defined in the original recommendations of Commission V.3 [published in *Pure Appl. Chem.* **18**, 439 (1969)].

4. Projects in Progress

(i) 'Study on Accuracy and Precision of Determination of Metals in Organic Compounds' (Started 1969—Project leader: INGRAM; Coinvestigator: GOMIŠČEK). The project was nearly complete and the report would be submitted to the Commission at its next meeting.

(ii) 'Destruction of Organometallic Compounds. Determination of Carbon, Hydrogen, and Nitrogen (Started 1971—Project leader: TEREŇ'EVA; Consultant: LÉVY; Completion date: 1975). The collected data from the literature were presented as the first part of the report. In the second stage an international investigation would be performed.

(iii) 'General Aspects of Trace Analytical Methods—III: Standard Reference Materials for Trace Analysis' (Started 1971—Project leader: KOCH; Completion date: 1975). The results of an enquiry on the availability and use of standard reference materials for trace analysis were presented. The Commission decided that the project should be continued to compile additional information on available standards.

5. Proposed New Projects

With regard to actual interest on various aspects of trace analysis, it was important to review the present status of the different techniques. From this viewpoint the projects detailed below were proposed. The project on the analysis of heteroelement organic compounds just completed by Dr. GEL'MAN had shown that organoboron compounds created most problems in routine work. Accordingly, the seventh project below was proposed as a continuation of the work in order to investigate this important problem and to recommend definite procedures.

(i) 'General Aspects of Trace Analytical Methods—IV: Contamination in Trace Analysis' (Project leaders: MIZUIKE and PÍNTA; Completion date: 1975).

(ii) 'General Aspects of Trace Analytical Methods—V: Trace Analysis of Surfaces' (Project leaders: MORRISON, CHENG, and GRASSERBAUER; Completion date: 1975).

(iii) 'General Aspects of Trace Analytical Methods—VI: Stability of Synthetic Standards: Solutions' (Project leader: GOMIŠČEK; Completion date: 1975).

(iv) 'General Aspects of Trace Analytical Methods—VII: Volatility Losses of Trace Elements in Destruction of Organic Substances' (Project leaders: CHENG and MACDONALD; Completion date: 1975).

(v) 'General Aspects of Trace Analytical Methods—VIII: Applicability of Destruction under Pressure in Trace Analysis of Biological Materials' (Project leader: GOMIŠČEK; Completion date: 1975).

(vi) 'Trace Analysis Applicable to Determination of Minor Impurities in Chemicals—IV: Application to Analytical Reagents' (Project leader: PINTA; Completion date: 1975).

(vii) 'Analysis of Organoboron Compounds' (Project leaders: GEL'MAN, MACDONALD, and TERENT'EVA; Completion date: 1975).

6. Membership

As Titular Members were nominated Prof. CHENG for an additional two years and as new Members Prof. A. MIZUIKE (Japan) and Dr. E. A. TERENT'EVA (USSR). Dr. GEL'MAN and Dr. G. INGRAM (UK) had completed their term of office as Titular Members and they were nominated as Associate Members.

Dr. M. GRASSERBAUER (Austria) was nominated as a ninth Titular Member because he was an expert on the field of electron beam microanalysis. The Commission asked for special permission from the Bureau to increase the number of Titular Members to nine. If this addition was not possible, Dr. GRASSERBAUER would remain an Associate Member.

7. Next Meeting

The Commission decided to request permission of the Division Committee and the Bureau to hold its next meeting in Paris in the Spring of 1974. At this meeting, the progress made in the cooperative study of standard reference materials for trace analysis would be reviewed and further plans developed. The other aspects of trace analysis in which the Commission was involved would also require discussion by that time.

COMMISSION ON ANALYTICAL NOMENCLATURE (V.3)

22–25 August 1973

Present: Prof. H. M. N. H. IRVING (Chairman), Prof. T. S. WEST (Secretary), Dr. G. BAUDIN, Dr. O. MENIS, Prof. E. B. SANDELL, Dr. H. ZETTLER (Titular Members); Prof. G. G. GUILBAULT, Prof. H. KAISER, Prof. O. SAMUELSON (Associate Members); Prof. W. FISCHER, Prof. W. KLEMM, Prof. H. A. TAWFIK (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting held in London on 22 November 1972 [see *Inf. Bull.* No. 45 (May 1973), pages 53–55] were confirmed.

2. Matters Arising from Minutes

It was noted that Dr. W. I. STEPHEN (Titular Member) was attending the meetings of Commission V.1 in Munich, following transfer of the standard substances project to that Commission.

Reporting on the meeting of Commission Secretaries with the Division Secretary in Munich on 21 August, the Secretary conducted preliminary business. It was necessary to draw up the Terms of Reference of the Commission—as presently seen by the Members. This was duly done following written submissions by Commission Members. The Commission decided that it should request a meeting in London (or Oxford) for November 1974. It had no items that required discussion at the Open Meeting of the Analytical Chemistry Division on 26 August. Also, the Commission discussed possible projects for raising funds for IUPAC and drew up a list of organizations that could possibly engage in collaborative testing. The results of these discussions were passed to the Division Secretary as requested.

3. Secretary's Report on Status of Projects

The Commission received the Secretary's annual report on the status of projects (dated March 1973). It was noted that the final reports on Nomenclature of Chromatography, on Thermal Analysis, and on Mass Spectrometry, and Nomenclature of Contamination Phenomena, had been forwarded to the Analytical Chemistry Division Committee and that their acceptance as recommended nomenclature would be sought from Council at Munich.

4. Trivial Names

This document was considered by the Commission and a version for circulation as tentative nomenclature was agreed upon following some minor modification.

5. Scales of Working

This document had been circulated as Tentative Nomenclature Appendix No. 18 (February 1972) to the *Information Bulletin*. Following discussion at the London (1972) meeting, in the light of comments received from many quarters, a simplified document had been prepared by the Secretary. Some minor changes were proposed and it was agreed that the document, as amended, should be sent to the Division Committee—following discussion with Commission V.2—as final recommendations.

6. Molarity – Normality – The Mole

This subject was discussed at great length by the Commission following submission of views by Prof. M. L. MCGLASHAN, Chairman of the Inter-divisional Committee on Nomenclature and Symbols. It was clear that no contradiction existed with the Commission's recommendation of the retention of the concepts and terms 'Equivalent' (German 'val') and 'normal'. The Commission therefore redefined the concepts in terms of the 'mole' as defined in the *Manual of Symbols and Terminology for Physicochemical Quantities and Units*. The term 'molarity' was not recommended. A final report was agreed for submission directly as a report—not involving nomenclature—to the Division Committee.

7. Presentation of Analytical Papers for Publication

The third version of this report prepared by Dr. G. F. KIRKBRIGHT, following submission of his second version to the London (1972) meeting of the Commission, was welcomed. Several points requiring further attention were discussed and it was agreed that these should be communicated to Dr. KIRKBRIGHT by the Secretary, with a view to producing a version for final circulation to the Commission before submission to the Division Committee.

8. Liquid-Liquid Extraction

The document from the Society for Chemical Industry Group submitted by Dr. N. M. Rice was considered in conjunction with the Commission's own report on this subject. Following discussion of various matters it was agreed that the Chairman should take the necessary action following discussions with Dr. RICE.

9. Kinetic Methods of Analysis

The first draft report, defining the various terms involved in kinetic methods of analysis and submitted by Dr. G. SVEHLA, was discussed. It was agreed that the Secretary should communicate the results of these discussions to Dr. SVEHLA in the hope that a revised draft report could be prepared for the projected meeting in 1974.

10. Ion Selective Electrodes

A final draft submitted by Prof. GUILBAULT and his Project Group was discussed in detail. It was agreed that the document should be revised in the light of these discussions, then submitted to Commission V.5 for further comment. Following acceptance by Commission V.5, the document would be recirculated to the Members of Commission V.3 if extensive alterations had been suggested; otherwise it could be forwarded to the Division Secretary for consideration as tentative nomenclature.

11. Selectivity Index

It was decided to revive this project with an augmented Project Group, which would engage in some compilation studies to test the feasibility of the project.

12. Criteria for Sensitivity, Detection Limits, Precision, and Accuracy

No report was available but the Commission decided to await the outcome of

the Commission V.4 report on such criteria in the area of analytical spectroscopy.

13. Nomenclature on Data Processing

There was no progress to report on this topic at the present time.

14. Joint Nomenclature Activities

A report was received from the Chairman on the activities of the Inter-divisional Committee on Nomenclature and Symbols.

15. Future Programme

At the suggestion of the Division Committee, the Commission undertook a new project to produce a compendium of recommended analytical nomenclature. Another new project undertaken at the suggestion of the Division Committee was on information storage and retrieval. Also, it was decided to explore extensions of the project on 'Presentation of Analytical Results for Publication' in the areas of

- (i) gravimetric analysis
- (ii) ion selective electrode analysis
- (iii) fluorescence-phosphorescence

16. Membership

The following Titular Members retired in Munich: Prof. SANDELL, Dr. STEPHEN, and Prof. WEST. Prof. H. FREISER, Prof. GUILBAULT, and Dr. RICE were nominated as new Titular Members. Dr. ZETTLER was appointed as Commission Secretary in place of Prof. WEST. It was decided to request special permission of the Bureau for Prof. IRVING to continue as Chairman until 1975. Prof. WEST was nominated as an Associate Member, as were Prof. FISCHER and Prof. G. TÖLG.

17. Any Other Business

There was none, but the Commission held a joint meeting with the Clinical Chemistry Section's Commission on Automation to discuss its project on the nomenclature of automation in analytical chemistry. There was a substantial measure of agreement between the two Commissions on the new terms proposed for definition.

COMMISSION ON SPECTROCHEMICAL AND OTHER OPTICAL PROCEDURES FOR ANALYSIS (V.4)

22-25 August 1973

Present: Prof. V. A. FASSEL (Chairman), Mr. B. F. SCRIBNER (Secretary), Prof. C. TH. J. ALKEMADE, Mr. L. S. BIRKS, Dr. A. C. MENZIES, Dr. E. PLŠKO, Prof. J. P. ROBIN (Titular Members); Prof. H. KAISER, Dr. A. KVALHEIM, Prof. V. VUKANOVIĆ (Associate Members).

1. The minutes of the previous meeting, held in Washington, DC, during 15-18 July 1971, had been published in *Comptes Rendus XXVI Conference* (see pages 184-185).

2. 'Nomenclature, Symbols, Units and their Usage in Spectrochemical Analysis-II. Terms and Symbols Related to Analytical Functions and their Figures of Merit' had been printed in tentative form by IUPAC (Tentative Nomenclature Appendix No. 26 to *Inf. Bull.*) in November 1972. The many comments received on the document were reviewed and final corrections were now made. The treatment of several advanced and somewhat abstract concepts relating to trace analysis were placed in an appendix or deleted entirely. It was believed that the document was strengthened by focussing on development of a uniform nomenclature for the more commonly used (or unused) terms and concepts. The document in its revised form was approved by the Commission and was forwarded on 23 August by the Chairman to the Division Secretary with a request for authority for publication.

3. The next document in the nomenclature series, entitled 'Nomenclature, Symbols, Units, and their Usage in Spectrochemical Analysis-III. Analytical Flame Spectroscopy and Associated Procedures' had also been printed in tentative form by IUPAC (Tentative Nomenclature Appendix No. 27 to *Inf. Bull.*) in November 1972. The document had attracted considerable attention and numerous comments were received. These were now reviewed and minor changes and corrections, none of them substantive, were made. The document in its final revised form was approved by the Commission and was forwarded on 23 August by the Chairman to the Division Secretary with a request for authority for publication.

4. The Commission reviewed progress on Part IV of the series of nomenclature documents, subtitled 'Analytical X-Ray Spectroscopy and Associated Procedures', a project headed by Mr. BIRKS. A draft had been circulated within the Commission and to selected outside experts in the X-ray field. The resulting comments were reviewed by the Commission and would be incorporated into a second draft which, after approval by the Commission, was planned for publication in tentative form in 1974.

5. The second currently active project was 'Systematic Classification and Description of Spectrochemical Radiation Sources', intended as Part V of the nomenclature series. This project was headed by Dr. PLŠKO, who had prepared a second revision of the nomenclature document and this was reviewed. A further revision would be prepared for reexamination by the Commission with publication as a tentative report planned for 1974.

6. The importance of concluding work on Parts IV and V to permit submission of the documents at the 1975 IUPAC Conference for adoption in final form was discussed. In view of the considerable consultation that appeared necessary to ensure this schedule, a meeting of the Commission was proposed

to be held in 1974. At that meeting the Commission would be divided into two Task Groups to expedite the completion of definitive reports. Accordingly, the Chairman prepared and forwarded a letter on 25 August to the Division President to urge approval of the special meeting by the Analytical Chemistry Division Committee.

7. At the request of the Division Secretary, the current terms of reference of Commission V.4 were reviewed by the Commission. The following statement of the 'Current and Projected Mission of Commission V.4' was prepared and forwarded to Mr. R. W. FENNELL on 25 August.

Current and Projected Mission of Commission V.4

(i) To complete the primary task of developing and publishing a uniform and consistent nomenclature, terminology, and symbolism for all fields of analytical spectroscopy.

(ii) To foster more extensive use of the definitive nomenclature documents developed in (i) on a worldwide basis, and more intensive collaboration with other international bodies, such as CEI and ISO, on matters of conflicting terminology.

(iii) To serve in an advisory and assistance capacity to: (a) Colloquium Spectroscopicum Internationale; and (b) various national organizations involved in nomenclature activities of more limited scope.

(iv) To sponsor and coordinate the compilation of fundamental data of interest to analytical spectroscopists.

8. New projects proposed by the Commission were as follows:

(i) Nomenclature, Symbols, Units and their Usage in Spectrochemical Analysis:

Part VI. Analytical Molecular Fluorescence Spectroscopy
(Project leader: Prof. J. WINEFORDNER)

Part VII. Analytical Molecular Absorption Spectroscopy
(Project leader: to be selected).

(ii) Preparation of a subject index for Parts I—VII of the nomenclature series (upon completion of Part VII)
(Project leader: Dr. A. STRASHEIM)

9. The Commission voted to bring to the attention of the Analytical Chemistry Division Committee the importance of liberalizing any restrictions on more extensive publication of IUPAC documents. The importance of worldwide distribution of definitive nomenclature documents, especially to the practicing chemist was stressed.

10. The election of Prof. FASSEL to the position of Chairman for the period 1973–75 constituted an extension of Titular Membership beyond the eight consecutive years period. The Commission voted unanimously to request the extension in order that the Commission's present project work could be most efficiently and speedily brought to completion under the leadership of Prof. FASSEL. Justification for extension of Prof. FASSEL's term for two years and a request for continuation of Dr. MENZIES' term of Titular Membership for two years were forwarded to the Division Secretary. Prof. J. WALTERS (USA) was nominated as a new Associate Member. One additional Associate Member would be chosen after solicitation of willingness to serve.

COMMISSION ON ELECTROANALYTICAL CHEMISTRY (V.5)

22-25 August 1973

Present: Prof. R. G. BATES (Chairman), Prof. J. F. COETZEE (Secretary), Dr. E. BISHOP, Prof. T. FUJINAGA, Dr. Z. GALUS, Prof. L. MEITES, Dr. H. W. NÜRNBERG (Titular Members); Prof. B. TRÉMILLON (Associate Member); Prof. J. JORDAN, Dr. P. O. KANE, Prof. W. KEMULA, Dr. G. KRAFT, Dr. D. D. PERRIN, Prof. N. TANAKA (National Representatives). Some of the meetings were also attended by Prof. I. M. KOLTHOFF (Analytical Chemistry Division Committee).

1. Minutes of Previous Meeting

The minutes of the meeting at Washington, DC, during 15–18 July 1971 (*Comptes Rendus XXVI Conference*, pages 186–188), were approved.

2. Reports

(i) Four reports on the purification of solvents had been published in *Pure and Applied Chemistry* since the 1971 (Washington) Conference: 'Purification of Dimethylsulfoxide for Electrochemical Experimentation' (REDDY); 'Purification of *N*-Methylacetamide and Tests for Purity' (TRÉMILLON); 'Pyridine: Purification and Tests for Purity' (MUKHERJEE); 'Propylene Carbonate: Purification and Tests for Purity' (FUJINAGA). Also published were a translation of 'Potentials d'Oxydo-Reduction des Corps Minéraux en Solution Aqueuse' (CHARLOT, TRÉMILLON) and, as an Appendix to the *Information Bulletin*, 'Classification and Nomenclature of Electroanalytical Techniques' (MEITES, NÜRNBERG, ZUMAN).

(ii) Seven new reports were approved (subject to minor modifications) by the Commission and would be submitted to the Division Committee: 'Scales of Ion Activity for Ion-selective Electrodes' (BATES, ROBINSON); 'Terminology and Symbol for Transfer of Solutes from One Solvent to Another' (TRÉMILLON, COETZEE); 'Status of Faraday Constant as an Analytical Standard' (BISHOP); 'Purification and Properties of *N*-Methylpropionamide' (HOOVER); 'Hexamethylphosphoramide: Purification and Tests for Purity' (FUJINAGA); Purification of Sulpholane and Tests for Purity' (COETZEE); 'Halfwave Potentials in Sulpholane' (COETZEE).

3. Continuing Projects

(i) An important continuing activity of the Commission was the production of Position Papers, in which the general status of certain fields of unusually broad scope was to be outlined briefly in order that the Commission might judge the desirability and feasibility of undertaking further projects in the field. Three such position papers were presented in Munich: 'Purification of Electrolytes' (BISHOP, GALUS); 'Pretreatment of Solid Electrodes' (BISHOP); 'Conditional Diffusion Coefficients' (BISHOP, GALUS). These Position Papers resulted in one of the new projects listed under Item 4, while the remaining areas were still under exploratory study.

(ii) Other continuing projects were the following: Halfwave Potentials in Dimethylformamide (COETZEE); Symbols and Terminology for Electroanalytical Techniques (MEITES, NÜRNBERG, ZUMAN); Standard Potentials in

Fused Salts (TRÉMILLON); Purification of Background Electrolytes (KEMULA, GALUS), on which a preliminary report was presented.

4. New Projects

Reports were expected within 18 months on the following new projects:

- (i) Diffusion Coefficients in Mercury (BISHOP, GALUS)
- (ii) Conditional Equilibrium Constants (NÜRNBERG)
- (iii) Selectivity of Ion-selective Electrodes (BATES, PUNGOR)
- (iv) Indicator and Reference Electrodes in Nonaqueous Solvents (COETZEE, TRÉMILLON)
- (v) Halfwave Potentials in Hexamethylphosphoramide (FUJINAGA, TRÉMILLON)
- (vi) Halfwave Potentials in Propylene Carbonate (FUJINAGA, TRÉMILLON)
- (vii) Purification of Dimethylformamide (COETZEE and others)
- (viii) Sign Convention for Current: Implications for Electroanalytical Chemistry (JORDAN, MEITES)
- (ix) Recommendations on Reporting of Electroanalytical Data (MEITES, ZUMAN)

5. Liaison with Other Commissions

Joint meetings were held with Commissions I.1, I.3 and V.6. Brief minutes of these meetings appear below.

(i) *Joint Meeting with Commission on Electrochemistry (I.3), 22 August 1973*
Present: Prof. R. G. BATES (V.5), Dr. E. BISHOP (V.5), Prof. J. F. COETZEE (V.5), Dr. I. EPELBOIN (I.3), Prof. T. FUJINAGA (V.5), Prof. R. HAASE (I.3), Prof. J. JORDAN (V.5), Dr. J. C. JUSTICE (I.3), Prof. L. MEITES (V.5), Prof. G. MILAZZO (I.3), Dr. H. W. NÜRNBERG (V.5), Dr. R. PARSONS (I.3), Dr. D. D. PERRIN (V.5), Dr. A. SANFIELD (I.3).

A draft prepared by Dr. PARSONS as an 'Electrochemical Appendix' to the *Manual of Symbols and Terminology for Physicochemical Quantities and Units* was considered. This discussion was a continuation of that taking place at a similar joint meeting held at the Washington Conference (1971), in which disagreement with some of the proposed symbols was expressed by Members of Commission V.5. Further discussion in Munich was limited mainly to the following suggestions made by members of Commission V.5: (i) Of the three symbols, E , ϵ , and U , only the first should be retained, using modifying subscripts where necessary, e.g., E_i , $E_{i=0}$, etc. (ii) The symbols I_+ and I_- should be replaced by I_a and I_c , respectively, or I_c and I_a , depending on the sign convention adopted for currents. This question, concerning the sign convention, was to be discussed with Commission I.1. Commission I.3 agreed to consider the above recommendations.

(ii) *Joint Meeting with Commission on Physicochemical Symbols, Terminology, and Units (I.1), 24 August 1973*

Present: Prof. R. G. BATES (V.5), Dr. E. BISHOP (V.5), Prof. J. F. COETZEE (V.5), Prof. M. FAYARD (I.1), Prof. T. FUJINAGA (V.5), Dr. Z. GALUS (V.5), Prof. J. JORDAN (V.5), Dr. P. O. KANE (V.5), Prof. A. PEREZ-MASIA (I.1), Prof. L. MEITES (V.5), Dr. H. W. NÜRNBERG (V.5), Dr. M. A. PAUL (I.1), Prof.

N. TANAKA (V.5) Prof. K. G. WEIL (I.1), Prof. D. H. WHIFFEN (I.1). The meeting was also attended by Prof. U. STILLE, Member of IUPAP and its SUN Commission.

The following subjects were discussed.

(i) It was the consensus of both Commissions that the term 'equivalent' was superfluous and might be ambiguous and that its use should be discouraged.

(ii) It was the unanimous opinion of Members of Commission V.5 that a general term 'concentration' was needed, and that its meaning should not be restricted to 'molarity'. Commission I.1 agreed to consider this matter further.

(iii) Members of Commission V.5 expressed a strong preference for i , rather than I , as a symbol for current, because this usage was deeply entrenched in the electroanalytical literature. This matter had already been discussed in a meeting of Mr. R. W. FENNELL and Prof. TRÉMILLON with Members of Commission I.1 in Paris in 1972. The position formulated by Commission I.1 was flexible, provided that internal consistency was preserved in any given document. It was agreed that in future documents drafted by Commission V.5 the symbol i would be acceptable, provided that it was stated in the introduction that the symbol recommended by IUPAC was I .

(iv) The sign convention for anodic and cathodic currents required that the former be considered positive and the latter negative. It was recommended that electroanalytical chemists change to the new convention; for example, for the process $\text{Cd}^{2+} + 2\text{e}^- \rightarrow \text{Cd}$, the voltammogram should be a plot of $-I$ (or $-i$) = $f(-E$ vs. SCE).

(iii) *Joint Meeting with Commission on Equilibrium Data (V.6), 24 August 1973*

Present: Dr. S. AHRLAND (V.6), Prof. R. G. BATES (V.5), Dr. E. BISHOP (V.5), Prof. J. F. COETZEE (V.5), Prof. T. FUJINAGA (V.5), Dr. Z. GALUS (V.5), Dr. E. HÖGFELDT (V.6), Prof. D. N. HUME (V.6), Dr. P. O. KANE (V.5), Prof. A. S. KERTES (V.6), Prof. Y. MARCUS (V.6), Prof. L. MEITES (V.5), Prof. G. N. NANCOLLAS (V.6), Dr. H. W. NÜRNBERG (V.5), Prof. B. TRÉMILLON (V.5).

The purpose of the meeting was to exchange information on matters of potential common interest so as to avoid duplication of effort by the two Commissions. The discussion centred on the need, if any, for tabulations of conditional equilibrium constants. It was agreed that if projects were undertaken in this field by either Commission, it would be advisable to narrow the scope of the projects to carefully selected electrolytes in a limited number of media (e.g., sea water).

6. Membership

Drs. BISHOP and GALUS were nominated for second four-year terms of Titular Membership. Prof. P. ZUMAN (currently an Associate Member) was nominated as a new Titular Member. New Associate Members were nominated as follows: Prof. JORDAN (currently USA National Representative), Prof. M. BRANICA (Yugoslavia), Dr. K. IZUTSU (Japan), Prof. B. NYGARD (Sweden), and Dr. J. MAŠEK (Czechoslovakia).

COMMISSION ON EQUILIBRIUM DATA (V.6)

23 and 25 August 1973

Present: Prof. D. N. HUME (Chairman), Prof. G. H. NANCOLLAS (Acting Secretary), Prof. M. T. BECK, Dr. E. HÖGFELDT, Prof. A. S. KERTES, Dr. D. D. PERRIN, Dr. J. STARÝ (Titular Members); Dr. S. AHRLAND, Prof. G. ANDEREGG, Prof. H. FREISER, Prof. K. YAMASAKI, Prof. Yu. A. ZOLOTOV (Associate Members); Prof. Y. MARCUS (National Representative).

1. Minutes of Previous Meeting

The minutes of the meeting held at Washington, DC, during 15–16 July 1971, had been published in *Inf. Bull.* Nos. 42/43 (July 1972), pages 3–5.

2. Chairman's Report

The Chairman reported on the activities of the Commission, summarizing the Status Report of the Commission for the period June 1972–May 1973 recently sent to the Analytical Chemistry Division Committee. Progress was noted on the 'Ion Exchange Equilibrium' report by Profs. MARCUS and HOWREY, which was now with the Division Committee. 'Equilibrium Constants of Liquid-liquid Distribution Reactions, Introduction and Part I: Organophosphorus Extractants' (MARCUS and KERTES) was in press. 'Critical Evaluation of Some Equilibrium Constants involving Organophosphorus Extractants' (MARCUS) was submitted to the Division Committee in September 1972, but had been delayed by postal difficulties. Approval had now been granted.

The Commission held a meeting in Toronto on June 26, 1972, at which seven Members attended [see *Inf. Bull.* No. 44 (December 1972), pages 52–54]. Prof. NANCOLLAS had acted as interim Secretary of Commission V.6 since that time.

3. Inorganic Stability Constants: Status Report

Dr. HÖGFELDT stated that he had located a number of compilers in Europe willing to participate in this project. The work of the Swedish school had been supported by a grant of some \$10,000 by the Swedish Government, but financial assistance was needed now to help meet the costs of preparation of the tables which would cover the literature to include publications in 1968. A five-year publication (1977) was planned for the second supplement. With regard to the publishing body, it was agreed that the opportunity should be offered to Butterworths to undertake the work. Prof. NANCOLLAS, in a subsequent meeting with Dr. L. C. CROSS, learned that the Chemical Society in UK might be interested in producing further supplements of the tables because the sale of previous volumes had proved satisfactory. The Commission felt, however, that the advertising of the volumes, especially in countries other than UK, left much to be desired. It was agreed that Prof. ZOLOTOV and Prof. BECK should investigate publishing possibilities in their respective countries. Clearly, it was necessary to find financial support, possibly from a prospective publisher, in order to help with the compilation of data and preparation of the tables. Drs. HÖGFELDT and PERRIN agreed to seek actively such support, after obtaining IUPAC permission.

4. Organic Stability Constants: Status Report

Dr. PERRIN reported that he had received excellent data compilations from Prof. K. B. YATZIMIRSKII and Dr. H. OHTAKI. A continuing problem, as noted under Item 3 for the tables of inorganic stability constants, was the need for financial assistance both for encouragement of compilers and for preparation of the actual tables. Dr. PERRIN indicated that the formation of a Sub-Commission to undertake the responsibility for supplying the compilations of stability constant data would help him not only to solicit further aid from Australian authorities, but also to persuade compilers to undertake the work. In a subsequent part of the meeting, the Executive Secretary suggested that the Commission should submit a request for the formation of a Sub-Commission on stability constant compilation involving both inorganic and organic liquids. This was subsequently done and approval was granted by the Division Committee. In addition, both the stability constant and solubility data (see Item 5) projects were submitted for consideration by the Bureau at Munich for financial support from outside of IUPAC.

5. Solubility Data Project

Prof. KERTES discussed in some detail the progress which had been made since the Washington meeting (1971), in organizing a solubility data project. Substantial agreement had been reached both with CODATA and with Gmelin Institut regarding their own roles in the project (see pages 205-206). The Commission endorsed the actions which had been taken and undertook to submit this project for financial assistance by trusts and foundations outside of IUPAC. In addition, Profs. KERTES and NANCOLLAS undertook to investigate possible sources of funds to support the solubility data project, after seeking the approval of IUPAC.

6. Liquid-liquid Distribution Projects

(i) *Marcus-Kertes Reports and Projects*. Part I of the series (Organophosphorus Extractants) was now at Butterworths for printing. There had been some delay due to retyping for offset printing, but the report was scheduled for publication in 1974. The Commission noted that the process would have taken some four years by the time the report was available for distribution. The critical compilation on organophosphorus extractants which was approved by the Commission in Toronto (1972) had subsequently been endorsed by the Division Committee.

Part II in the series (Prof. KERTES), dealing with alkylammonium extractants, had been approved by the Commission. It was agreed that in view of the long time required for production of these reports, the project should be divided into four volumes:

Part I. Introduction and Tables for Organophosphorus Compounds

Part II. Alkylammonium Salts

Part III. Other Extractants

Part IV. Equilibrium Constants of Liquid-liquid Distribution Reactions involving Chelating Agents (STARÝ and FREISER)

In a discussion of the ways in which the publication procedure might be accelerated, Prof. FREISER indicated that for a specific project, consideration was being given by the Division Committee to authorize one of its Members,

after calling on the services of experts in the field, to approve manuscripts on behalf of the Division Committee. Prof. FREISER urged the Commission to explore a similar procedure for its own liquid-liquid distribution reports. It was pointed out that the writing of these reports was solicited on a voluntary basis and the delays in publication caused much frustration amongst the volunteer authors. On the same subject it was agreed that, with the exception of the summer months, Members of Commission V.6 should be allowed two rather than three months to submit their comments on submitted manuscripts. The Chairman and Secretary were authorized to approve Part III, which was now in its final stages, and to forward it to the Division Committee. Prof. MARCUS undertook to send the Officers the last few pages of this report before the end of October; he did not see the need for a supplement to Parts I, II, and III for the next few years. Commission Members were urged, when submitting comments to the authors of reports, to send copies of these comments and criticisms to the Chairman and Secretary. The Officers could not be expected to make decisions on the approval of reports unless they could see how the authors, in preparing the final drafts, had handled the reviewers' comments. Prof. BECK suggested that the authors should also send copies of the comments with their submitted final draft in order to be sure that this material reached the Officers.

(ii) *Stary-Freiser Report*. Part IV was now ready for retyping. In this report, the listing of chelating extractants in family groupings was felt to offer considerable convenience to users of the tables. Metal ions were listed in the same order as found in the stability constant tables, and the authors agreed to keep in close touch with Dr. PERRIN in order to ensure the use of compatible reference systems. With the exception of Part I, which was already in press, it was agreed that Parts II-IV would contain a uniform introduction on the use of the tables (to be agreed before 31 August amongst the authors MARCUS, KERTES, STARÝ, and FREISER) and in addition three indexes (alphabetical, empirical formulae, and metal ions). It was urged that IUPAC-approved nomenclature be used. The tables would be circulated amongst Commission Members concerned with solvent extraction (FREISER, HÖGFELDT, KERTES, MARCUS, PERRIN, STARÝ, and ZOLOTOV) for review and comment, then the final draft would be sent to the Officers for approval [see (i) above].

(iii) *Critically Evaluated Distribution Equilibrium Constants*. A report (Prof. MARCUS) on the critical evaluation of some equilibrium constants involving organophosphorus extractants had been approved by the Division Committee and forwarded to Butterworths: publication was expected in approximately one year. A second part in the series had been submitted by Prof. KERTES and, following appropriate action on reviewers' comments, the Commission authorized the Officers to approve the manuscript for publication [see (i) above regarding instructions for submission of reviewers' comments]. It was agreed that authors be solicited from outside the Commission to undertake the preparation of critical evaluations of liquid-liquid distribution data on selected systems. It should be made clear that these evaluations were not the official opinion of IUPAC, but only of the particular author. Also, it was agreed that the series should be combined with the critical evaluation of stability constants and that a common policy statement should be sent to all authors (see following Item). Within the liquid-liquid distribution part of the project, Profs. STARÝ and ZOLOTOV undertook to prepare a report on 8-hydroxyquinoline to include both heterogeneous distribution and stability data.

7. Critical Surveys of Stability Constants

Prof. BECK and Dr. HÖGFELDT reported little discernible progress on Prof. G. BIEDERMANN's chapter on 'Ionic Media', although Prof. KERTES indicated that the chapter was proceeding. It was agreed that Prof. BECK should add a note on the choice of ionic medium in his introductory chapter to the series, with an intimation that a more extensive treatment by Prof. BIEDERMANN would be forthcoming and would form a later part of the series. Also, it was agreed that the stability constant and liquid-liquid distribution data should be merged into the same series of volumes on the critical surveys of equilibrium data, with the exception of the chapter by Prof. MARCUS dealing with organophosphorus extractants which was already in press. All authors undertook to participate in the drafting of introductory guidelines for the series and Prof. BECK agreed to add a paragraph to his introductory chapter dealing with liquid-liquid distribution data.

The Commission agreed that the critical surveys should mention all of the available literature, employing the uniform bibliographic system used in the stability constant tables. This would give information to the reader as to which values were rejected in the critical evaluation. A great deal of discussion was concerned with whether or not a recommended value should be given for each complexing system. The Commission felt, in general, that recommended values should be given where at all possible but that where there was extreme uncertainty in the choice, a statement should be added, in addition to the normal standard deviation, warning the user that the value was indeed very tentative. Prof. BECK undertook the preparation of a revised set of criteria and suggestions for prospective authors and the circulation of these to Commission Members by 15 October. In sending their comments, Members agreed to let Prof. BECK have suggestions for authors, ligands, and systems for future volumes in the critical survey series. Prof. BECK would prepare a short statement for publication in *Pure and Applied Chemistry*, soliciting work from participating authors. Prospective authors would be instructed to send to Prof. BECK outlines of a possible contribution rather than the finished manuscripts.

The introductory chapter to the series (BECK) would shortly be ready for publication. The Commission congratulated Profs. ANDEREGG and BECK on their critical evaluations of EDTA and cyanide complexes and promised to send their comments to the authors within the next week or two. The Officers of the Commission were formally authorized to approve for publication the final revised versions of these reports. Commission Members were urged, when submitting comments, to send copies to the Chairman and Secretary.

In choosing names of participating authors in the series, it was agreed that suggested names would be circulated to Commission Members for comment prior to a formal request for an article. The Commission endorsed the following reports which had been solicited by Prof. BECK:

Drs. BOND and HEFTER (Melbourne) on fluoro complexes

Prof. MCBRYDE (Waterloo) on phenanthroline and dipyriddy complexes

Prof. GRENTHE (Sweden) on lanthanide complexes

In addition, Prof. ANDEREGG had agreed to write a critical survey on nitrilotriacetate metal complexes.

Each critical survey would be published in *Pure and Applied Chemistry*, enabling the series to be bound at a later date in a more permanent, hard-cover volume.

8. Nomenclature and Symbols for Mixed Ligand Equilibria

The Commission generally endorsed the proposal made by Profs. HUME and NANCOLLAS and suggested that it be extended in order to include polynuclear metal complexes. The authors undertook to prepare a further draft for submission to Commission Members and, following approval, to the Commission on Analytical Nomenclature (V.3). It was unanimously agreed that where such specialized symbolism was concerned, it was the responsibility of Commission V.6 to make recommendations. The growth in data on mixed ligand complexes made such a recommendation necessary.

9. Nomenclature and Symbols for Conditional Constants

The need for a uniform symbolism for conditional constants was discussed. A Working Group, consisting of Prof. FREISER (Leader), Dr. PERRIN, and Prof. BECK, agreed to explore whether such a recommendation was worthwhile or indeed desirable and to report back to the Commission.

10. Data Retrieval: Status of Data Flagging Project

At an open meeting to discuss this proposal in Munich (see page 204), the proposal was generally well received. Plans had been formulated for further action with the intention to try and introduce a flagging system by Chemical Abstracts Services in 1976.

11. Dissociation Constants of Acids and Bases

The Commission agreed that there was a need for a compilation and evaluation of PK values for acids and also nonmetal ion-pairs with ligands in aqueous, non-aqueous, and mixed solvents. A small Working Group, consisting of Dr. PERRIN, Prof. NANCOLLAS, and Dr. AHRLAND, was charged with finding someone to undertake this task. The work would supplement the compilation of KORTUM *et al.* dating back to 1961.

12. Nonaqueous Equilibrium Constants

At the Washington meeting (1971), Prof. S. BRUCKENSTEIN was commissioned to investigate the possibility of a compilation of nonaqueous equilibrium constants. No proposal had been presented and Commission V.6 voted to drop this project for the present.

13. Election of Officers and Members

With the election of Prof. HUME to the Division Committee, the Commission endorsed the appointment of Prof. NANCOLLAS as Chairman and Dr. Ahrland as SECRETARY. Profs. HUME and MARCUS would become Associate Members. Prof. BECK, whose term as Titular Member expired at the Munich meeting, would also become an Associate Member. Profs. ANDEREGG and FREISER would assume Titular Membership. Two new Associate Members were nominated: Dr. H. OHTAKI (Japan) and Dr. C. L. YOUNG (Australia). Two further appointments of Associate Members would be arranged by mail within the coming two months.

14. Date and Place of Next Meeting

Five or six Members indicated their intention of attending the XVI Inter-202

national Conference on Coordination Chemistry in Dublin in 1974, and it was agreed to request that this be regarded by IUPAC as a meeting of Commission V.6.

15. Terms of Reference of Commission

The Chairman had been requested to prepare updated terms of reference for Commission V.6. It was agreed that this should include:

- (i) compilation and publication of comprehensive tabulations and critical reviews of equilibrium data;
- (ii) stimulation of work in this field and coordination of the activities of others;
- (iii) responsibility to assist in the recommendation of specialized symbolism and nomenclature in the chemistry of equilibria.

Meeting on Data Flagging

22 August 1973

Present: Prof. D. N. HUME (Chairman), Prof. M. T. BECK, Prof. T. FUJINAGA, Dr. E. HÖGFELDT, Prof. G. H. MORRISON, Prof. G. H. NANCOLLAS, Dr. D. D. PERRIN, Dr. W. H. POWELL, Dr. T. A. RAFTER, Dr. J. STARÝ, Dr. J. C. WHITE.

The meeting was held in order to ascertain the interest in Commission V.6, in other Commissions of the Analytical Chemistry Division, and within IUPAC as a whole, in a proposed data flagging project. The Chairman, Prof. HUME, pointed out that in many scientific publications there might be valuable experimental data which remained unabstracted and very difficult to find.

A small *ad hoc* Committee had begun to investigate the possibility of flagging such data in the abstracts of papers, using two-letter flags for important physical quantities. The list of proposed 'flags' had been distributed to Division and Commission Chairmen and Secretaries and others who might be interested: the general enthusiasm for the project was encouraging. It was suggested that few papers would require as many as five such flags in order to describe properly the data presented.

The idea was generally well received by the meeting and most of the discussion centred around:

- (i) the need to include areas other than chemistry, *e.g.*, biochemistry, polymer chemistry, *etc.*,
- (ii) how to institute this, perhaps in a pilot scheme, as soon as possible.

Clearly, such a system had to have universal acceptance by editors of journals and by Chemical Abstract Services (CAS). In the latter case Dr. POWELL said it must be possible to add the flags in the abstracts in such a manner that they would not be confused with similar abbreviations already accepted and with a totally different meaning (*e.g.*, CD—usually circular dichroism, was proposed here as critical constants). It was generally felt that it would be wise to avoid undue overlap, but a suggestion that these physical data should be identified by a numerical coding was rejected by the meeting, which favoured a simple two-letter coding.

One problem discussed was the way in which the 'hardness' of the data could be indicated in the flagging scheme. Prof. FUJINAGA outlined a system which was presently being discussed in CODATA in which an (a) to (g) classification represented a decreasing degree of 'hardness'. Prof. FUJINAGA would supply Prof. HUME with the details of this proposed classification.

In order to meet a deadline for possible adoption of a flagging system by CAS in 1976, it would be necessary to reach agreement on the details of the abbreviations by 1 January 1975. The meeting urged the Chairman to institute immediate discussions with other IUPAC Divisions in order to reach agreement on details of the flags to be adopted and to bring the classification system into operation at the earliest possible date, even if only on a pilot scale. CAS would be asked to comment on the proposed abbreviations in order to ensure maximum possible compatibility with existing symbols in common use.

Meeting on Solubility Data Project

24 August 1973

Present: Prof. D. N. HUME (Chairman), Dr. S. AHRLAND, Prof. I. ELIEZER, Dr. E. HÖGFELDT, Prof. A. S. KERTES, Prof. W. KLEMM, Dr. W. LIPPERT, Prof. G. H. NANCOLLAS, Dr. C. SCHÄFER, Dr. H. STRUNZ, Prof. Yu. A. ZOLOTOV. The Executive Secretary was in attendance for part of the time.

The Chairman, Prof. HUME, indicated that approximately two years ago the need for compilation of solubility data was recognized and an appointed Project Group (HUME, KERTES, and NANCOLLAS) had confirmed the necessity and feasibility of such an undertaking. The purpose of the present meeting was to reach an agreement between the participating bodies—IUPAC, CODATA, and Gmelin Institut—that such a project was valuable and desirable, so that the proposal could be presented to the appropriate IUPAC authorities.

Prof. KERTES dealt at some length with both the proposed organization and scientific direction of the project. He pointed out that such data were of considerable value not only to chemists, but also to scientists in other disciplines (*e.g.*, geo-sciences, oceanography, technology, engineering, biology, and medicine). Care would be taken to see that the compilation procedure took into account the individual needs of these various fields. The method presently envisaged for collecting the data would be to divide the project into three main topics, comprising the solubilities of (a) gases, (b) liquids, and (c) solids. Each topic would be divided up into relatively small assignment units so that the work of individual compilers, experts in the field, would be facilitated. It was hoped that the first values would be ready for publication in 1977. At a meeting in September 1974 the Project Group would discuss guidelines and contributors, then report back to Commission V.6 for approval in June 1975. It was proposed that the project would not end with the comprehensive initial compilation, but would be continued through the formation of a Solubility Center (in cooperation with CODATA) so that the more efficient dissemination of solubility values and the collection of new data could be facilitated. The Project Group had requested permission to release this, a major project, from IUPAC publication restrictions and such permission had been granted. The Gmelin Institut (Dr. LIPPERT) had agreed to do the technical editorial work for the project and prepare the volumes. Costs would be borne in advance by Gmelin, and any profits from the sales of the tables would be channelled, perhaps through CODATA, back to the project. IUPAC would assume entire responsibility for the scientific side of the project.

Prof. ELIEZER said that CODATA discussion had centred around three topics: (i) nomination of a CODATA representative for the proposed IUPAC Sub-Commission, (ii) setting up of an *ad hoc* Task Force to determine the interest of other scientific Unions, and (iii) possibility of participation of CODATA in the formation of a Solubility Center. CODATA had decided favourably on (i) and Prof. ELIEZER had been asked to represent CODATA at the present IUPAC meetings in Munich. Prof. ELIEZER was in process of contacting member Unions of ICSU to determine the degree of interest prior to the formation of the *ad hoc* Task Force under (ii). Prof. KERTES undertook to provide a more comprehensive form of the proposal for the solubility project for use by Prof. ELIEZER in eliciting the interest of the other scientific Unions.

Dr. STRUNZ, representing the International Mineralogical Association, indicated that there was a great deal of interest in the solubility data project, both by IMA and by the larger body IUGS. It was again agreed that the scientific organization of the project would take into account the needs of nonchemists so that the value of the compilations would be maximized.

In answer to a question by Prof. KLEMM concerning the source of finances to support the individual compilers, Prof. KERTES thought that the very limited scope of each assignment unit would tempt many of the authors to participate without recompense. The Executive Secretary advised the Commission to submit a proposal within IUPAC so that financial support could be sought from trusts and foundations. Dr. SCHÄFER suggested channelling such proposals for funds through UNISIST so that governments involved could be approached from three sides: UNISIST, IUPAC, and CODATA.

In describing the work of the proposed Solubility Center, Prof. KERTES said that it would probably be involved in the inclusion of solubility data on tape for efficient retrieval.

COMMISSION ON ANALYTICAL RADIOCHEMISTRY AND NUCLEAR MATERIALS (V.7)

23-27 August 1973

Present: Dr. M. B. A. CRESPI (Chairman), Dr. J. C. WHITE (Acting Secretary), Dr. F. GIRARDI, Prof. F. HECHT, Prof. L. KOSTA, Prof. N. SAITO (Titular Members); Dr. G. B. COOK, Dr. M. SANKAR DAS, Dr. E. STEINNES (Associate Members); Dr. T. A. RAFTER, Dr. M. DE BRUIN (National Representatives); Dr. H. F. ALY, Dr. A. EL SHARNOUBY, Dr. P. D. LAFLEUR (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting in Washington, DC, on 16-18 July 1971 had been published in *Comptes Rendus XXVI Conference* (pages 191-193) and of the interim meeting in Kyoto on 4 and 6 April 1972 in the *Information Bulletin* [Nos. 42/43 (July 1972), pages 20-22].

2. Reports

Published: 'Recommendations on Nomenclature for Nuclear Chemistry' [Tentative Nomenclature Appendix No. 25 (June 1972) to the *Information Bulletin*].

In press: 'High Energy Photon Activation' (*Pure and Applied Chemistry*, 1974)

Submitted: 'Recommendations on Reference Materials for Trace Analysis by Radiochemical Methods' (announcement in the *Information Bulletin*).

3. Purity of Reagents and Labelled Compounds

(i) Dr. G. GOLDSTEIN (Oak Ridge National Laboratory, USA) was present as the official representative from IUB. Also present were Prof. N. LOZAC'H (Chairman), Mr. S. P. KLESNEY (Secretary), Dr. K. L. LOENING, and Prof. J. RIGAUDY (Titular Members) of the Commission on Nomenclature of Organic Chemistry (III.1). It was agreed that the question of nomenclature of organic labelled compounds and biochemicals was well covered by Commission III.1 and not a matter of primary interest to Commission V.7 though it would like to be kept informed of developments. The interest of Commission V.7 was basically in the purity aspects and their analytical control. Action was taken to appoint Dr. GIRARDI, assisted by Dr. D. COMAR, to meet as a Joint Committee with representatives of IUB on this matter. This proposal was accepted by Dr. GOLDSTEIN.

(ii) The name of the project was changed to 'Radioactive and Isotopic Specifications of Labelled Compounds', a title more descriptive of the actual work involved.

4. Terms of Reference of Commission V.7

The updating of the terms of reference of the Commission, drafted by Chairman CRESPI at the request of the Division Secretary, was discussed and adopted with some corrections (see Appendix). It was suggested by Dr. DE BRUIN at a later meeting that point 3 should include also the techniques used in biological and medical applications for analytical purposes. This was approved.

5. Proposed Division of Nuclear and Radiochemistry

The Commission had been asked by the Executive Secretary and also by Prof. S. AMIEL, Chairman of the Israel Chemical Society, to give its opinion on a proposal for creation of a Division of Nuclear and Radiochemistry within IUPAC. It was agreed that due to its importance in modern chemistry, nuclear and radiochemistry deserved wider recognition inside IUPAC. Such recognition was supported by the Commission. It was also agreed that Commission V.7 should remain in the Analytical Chemistry Division, where it properly belonged, even if a new nuclear and radiochemical body was created, because its activities were focussed on an inherently analytical approach rather than on the nuclear characteristics of the techniques involved.

6. Trace Analysis

(i) The role of Commission V.7 in trace analysis was discussed. It was agreed that, due to the importance of activation analysis and other radioanalytical techniques in most aspects of this field, trace analysis was a central part of the Commission's activities. The formation of a Coordinating Committee with representatives of other Commissions also interested in the problem, as well as the Applied Chemistry Division, was favoured. The Chairman was asked to present this viewpoint at the Division Committee meeting.

(ii) The matter of reference materials for trace analysis by radioanalytical techniques was discussed. The Commission had already recommended two materials available from the US National Bureau of Standards (NBS). The possibility was considered of recommending also the "kale" material prepared by Dr. H. J. M. BOWEN (UK Atomic Energy Authority), because sufficient data obtained in different laboratories appeared to exist on it. Dr. SANKAR DAS was appointed to analyze the data available on this material and distribute them to Commission Members for consideration. The same procedure would be followed with the rock samples issued some years ago by US Geological Survey; Dr. STEINNES was asked to report on the data available in this case. Discussion was also held on the high-purity calcium carbonate prepared by NBS, and it was agreed to encourage further studies on it, because it showed promise as a readily soluble reference material for trace analysis of impurities. The NBS bovine liver standard was also discussed, and interest was expressed in it.

(iii) Dr. GIRARDI, Prof. HECHT, Prof. KOSTA, and Prof. SAITO commented on data obtained in their laboratories on the NBS reference materials presented two years ago by Dr. W. W. MEINKE to Commission Members. Dr. LAFLEUR expressed the interest of NBS in the work of the Commission in this field, in which the necessity of good reference materials was growing. Dr. CRESPI commented that the Commission considered as one of its duties the encouragement of work by national and international organizations capable of making significant contributions to the solution of this critical problem.

7. ISO Project on Water Quality

The Commission reviewed the proposal circulated by the Division Secretary and expressed its interest in the radioanalytical aspects of the project. The Secretariat should keep the Commission informed on its development for appropriate comment or action in the future.

8. Teaching of Radiochemistry

(i) Discussion was held on the merits of establishing some international agreement on what should be taught in radiochemistry at the university level and on Prof. J. JORDAN's proposal to do similarly in instrumental analysis courses, because these should include the use of radioanalytical equipment. It was decided to assign Prof. SAITO to follow this question for Commission V.7.

(ii) A joint meeting was held with Prof. R. W. PARRY and Mr. D. G. CHISMAN, Officers of the IUPAC Committee on Teaching of Chemistry. The Commission was informed about the activities of the Committee, and comments on the present state of the teaching of radiochemistry were made by both bodies. The Commission expressed its concern regarding the lack of information on nuclear subjects of the general, educated public, a matter of importance in an era in which applications reached many aspects of everyday life. In this respect, the possibility to sponsor courses at secondary schools, using only natural radioactivity, was discussed. Also, it was generally felt that most university curricula in science did not cover radioactivity matters properly or at all, and action was taken to appoint Dr. GIRARDI, assisted by all Commission Members, to collect information on the current state of the problem in different countries for further discussion and analysis of possibilities at the next meeting. The IUPAC-UNESCO publication *Survey of Chemistry Teaching at the University Level* and the IAEA publications on teaching of nuclear sciences, should provide an initial guide for the purpose.

9. Nomenclature

Comments received on the tentative 'Recommendations on Nomenclature for Nuclear Chemistry—Part I' (see Item 2 above) and the terms to be included in Part II, were considered. Attention was called by some Members to the desirability of agreement as much as possible with a glossary published by ISO, which covered the general nuclear field and included radiochemical terms. After discussion, it was agreed that the tentative Recommendations—Part I, should not be submitted for final publication but consolidated with Part II in a new tentative form which would be more comprehensive. If feasible, this second version of the tentative recommendations should contain multilingual equivalents of the terms included.

10. Nuclear Techniques for Analysis of Key Elements in Environmental Pollution

The final version of the report on 'Lead', prepared by Dr. A. J. HISLOP (UK Atomic Energy Authority) at the request of the Commission, was approved. A draft of a report on 'Cadmium' prepared at the request of Dr. WHITE by members of his laboratory, was considered in general; detailed comments would be made by correspondence to Dr. WHITE. The report on 'Mercury', selected as the third of the series at the last meeting, was dropped because of the recent appearance of comprehensive reviews. It was agreed that 'Selenium' or 'Arsenic' should be the next subject. The project leader (WHITE) should decide on this.

11. Analysis of Nuclear Materials

(i) The report on the analytical chemistry of nuclear fuels was dropped, because ASTM had prepared a detailed series of analytical procedures on the subject that would be published in book form in 1974. Discussion was held on

the shift of interest in this topic to nuclear materials in general, but no firm action was decided upon. It was agreed to keep the project on a reserve basis, because it was a matter of continuous interest to the Commission.

(ii) Consideration was given to the possibility to recommend, as reference materials for the analysis of uranium in low-grade ores, the samples prepared by the IAEA with the collaboration of the Commission [*Pure Appl. Chem.* **27**, 291 (1971)]. Prof. KOSTA was appointed to review the existing data on these materials and distribute them for consideration.

12. Flux Monitoring in Activation Analysis

The report by Prof. R. E. WAINERDI on this subject was approved with some minor modifications. The Chairman was authorized to submit it for publication, after consolidation of the corrections. The title would be 'Recommended Procedure for Measurement of 14-MeV Neutron Fluxes from Accelerators for Activation Analysis'.

13. Light Element Analysis by Radioanalytical Methods

Dr. CRESPI reported on the status of this project and proposed a more narrow scope, because the initial idea proved to be too ambitious. This was approved, and the report was expected to be ready before the next meeting.

14. Review of Reviews on Radiochemistry

At the request of Dr. COOK, this project was terminated, because the survey made showed it not to be of significant interest to users.

15. Methods of Analysis of Fissile Elements

Dr. GIRARDI circulated a partial draft of this survey report for comment. Agreement was reached to restrict its scope to the use of nuclear techniques. Dr. SANKAR DAS was assigned to review the current state of the art on the nonnuclear techniques on this topic.

16. Separation Techniques in Radioanalytical Chemistry

Prof. SAITO reported on the status of this project and circulated a partial draft. It was agreed that the report should be more a compilation of data than a description of procedures and that, due to its length, should be divided into four parts entitled: 'Ion Exchange', 'Solvent Extraction', 'Precipitation and Adsorption', and 'Miscellaneous Techniques'. The first of these was expected to be ready by the end of 1973.

17. Newsletter of Commission Activities

Drs. CRESPI and WHITE reported that this project, suggested at the 1972 meeting of the Commission in Kyoto and considered appropriate, proved afterwards to be impracticable due to the cost involved. It was agreed that it should be terminated.

18. Reprints

A larger distribution of reprints of the reports of the Commission was considered desirable. In particular, the Chairman was requested to ask that at least 150 extra copies of the report on the measurement of neutron fluxes (see Item 12 above) be distributed by the Secretariat to interested scientists. The list would be provided by the Commission.

19. Dissemination of Activities

Dr. CRESPI circulated a report on the history and activities of Commission V.7. The report was approved and would be sent to journals of analytical and nuclear chemistry for publication as a news item, so that the work of IUPAC in the field would become better known.

20. Data Flagging Project

Dr. WHITE reported on the meeting in Munich on this subject, chaired by Prof. D. N. HUME (Commission V.6). Suggestions by Members of Commission V.7 had been made on the flags to be used for radioanalytical data. Prof. HUME hoped to compile a final selection of flags so that the project could be started by 1976. Chemical Abstracts Service would cooperate.

21. Compilation of Radioanalytical Data

The necessity of such compilation was discussed in relation with the CODATA project. It was agreed that in many cases data useful for radioanalytical chemistry was scattered in the literature in a noncritical form. Prof. HOSTE was assigned to make a critical compilation of the essential data necessary and Members were asked to send their suggestions to him.

22. Register of Radioanalytical Workers

The necessity to compile a register of scientists engaged in activation analysis and other radioanalytical techniques, to whom the action of the Commission could be extended, was stressed. Prof. WAINERDI was assigned to prepare this list on the basis of attendance of international conferences and on suggestions received from all Members.

23. Nuclear Techniques for Analysis of Molecular Compounds involved in Environmental Pollution

The increasing use of radioanalytical techniques to assay molecular contaminants was recognized at the meeting. Prof. KOSTA was assigned to look further into the matter and report on the state of the art and potential of this application.

24. Analysis of Thorium and Thorium Compounds

Comments on this subject made at the meeting suggested that a review was appropriate at the present time. Dr. SANKAR DAS was assigned this task.

25. Charged-Particle-Induced X-Ray Fluorescence

The possibilities of this new nuclear technique, using a particle accelerator, were emphasized by Dr. RAFTER, who was appointed to prepare a report on its use and possibilities.

26. Membership

The proposed composition of the Commission for the next biennium was decided by election. Dr. CRESPI was reelected as Chairman, with a special request to the Bureau to prolong his Titular Membership for an additional two years in order to allow him to remain in Office. Dr. WHITE was elected as the new Secretary to replace Prof. WAINERDI. Profs. WAINERDI and KOSTA were reelected for a further four years as Titular Members, and Dr. SANKAR

DAS and Prof. HOSTE, former Associate Members, were elected to replace Prof. HECHT, who retired after four years, and Dr. A. A. SMALES, who completed an eight-year Titular Membership and was elected as a new Associate Member. Other new Associate Members were Dr. RAFTER and Prof. F. LUX (Federal Republic of Germany).

Appendix—Terms of Reference

1. To keep, as a body of experts, informed on the progress obtained in the fields of radioanalytical chemistry and nuclear materials and to try, by collective and individual action, to contribute to its further development.
2. To study problems of nomenclature related to nuclear and radiochemistry and to issue recommendations in that respect.
3. To examine critically and recommend suitable methods for the analysis of nuclear materials and for analytical situations in general, such as those encountered in materials sciences, biology, and medicinal chemistry, in which the application of activation analysis or other radioanalytical techniques appears advantageous.
4. To study the analytical aspects of radioactive waste disposal and the application of radioanalytical methods to environmental problems.
5. To recommend existing reference materials as suitable international standards for nuclear use.
6. To encourage the preparation of new reference materials for international use and, when feasible, to contribute to their preparation and study.
7. To sponsor international comparisons on samples and methods presenting special problems and to keep informed on efforts made in the same direction by other international groups.
8. To publish review papers on the 'state of the art' of problems of importance in its field of competence.
9. To participate, in coordination with other Commissions also interested in the problem, in the overall IUPAC effort on trace analysis.
10. To promote the wider use of radioanalytical techniques by gathering and disseminating information on the applicability of radiochemical methods to analytical problems.
11. To establish specifications for radioactive products in general, including labelled compounds, whenever feasible, and to try to have them adopted for general use.
12. To evaluate critically nuclear data and procedures used when dealing with radioactivity measurements in analytical chemistry.
13. To participate, collectively or individually, in international meetings on subjects of its competence, and to advise higher IUPAC bodies on requests for official sponsorship by the Union.
14. To give advice to higher IUPAC bodies on matters of its competence related to the chemical aspects of radioactivity.
15. To disseminate information in the radioanalytical community on the work of IUPAC, trying by means of personal action in international meetings and publications in national and international journals, to affirm the position of IUPAC in international chemistry.

OPEN MEETING OF ANALYTICAL CHEMISTRY DIVISION

26 August 1973

1. President's Opening Remarks

The Division President, Prof. KEMULA, welcomed all those present including three former Presidents, Profs. BELCHER, KOLTHOFF, and P. WEST. He asked the meeting to stand for a moment in memory of Prof. A. RINGBOM.

The President said that he was very glad to be able, in his biennial report to the Bureau and Council, to present a statement of real progress in the work of the Division in spite of the severe financial cuts that had been imposed in 1972. He congratulated the Members of the Division and thanked them for all their efforts.

2. Elections to Division Committee

The Secretary formally announced the results of the elections to fill the vacancies occurring in the Division Committee:—

America — Prof. D. N. HUME (USA)

Germany — Prof. H. KAISER

The President welcomed these new Members of the Committee and thanked the retiring Members, Profs. FREISER and FISCHER, for their work during the past four years.

3. Summary of Division Committee Business

The Secretary gave a brief account of the items being considered by the Division Committee during the Conference in Munich. The President invited comments from those present.

Reservations were expressed on the proposed 'Compendium of Analytical Nomenclature'; it was feared that reluctance to change a published compilation might lead to stagnation; it was hoped that the original style of recommendations would not be changed; it was suggested that, to be useful, the Compendium should be short and not contain terminology for subjects undergoing rapid development. In reply it was stated that production of the Compendium would force the updating of existing recommendations and, by collecting them into one volume rather than having them scattered in numerous volumes of *Pure and Applied Chemistry*, would bring them to the attention of working chemists. It was hoped that the first edition would be published in three-four years and that revision should be a continuing project, allowing not only amendment of recommendations already included but also the addition of new items.

The point was made that there had been no feedback from ISO on many of the comments made by IUPAC on draft standards and it was hoped that a proposed new system would rectify this situation. Also, it would be helpful if references to the originators of the methods proposed in a draft could be given. It was stated that the new system should take care of the first point and that ISO would be informed of the second.

It had been noted that approval of the revised Division Rules had not yet been put before the Bureau because the IUPAC Statutes and Bylaws (1965) were currently under review by the Committee on Statutes and Bylaws under

the Chairmanship of Sir DAVID MARTIN. Members could write in to the Chairman if they had any comments they wished to make. It was proposed that the Division President should suggest, at the Division Presidents' Meeting in Munich, that a member from each Division should meet at the next Conference, as an informal *ad hoc* Committee, to discuss the Statutes in relation to the day-to-day working of the Divisions.

4. Any Other Business

(i) *Harmonization of Collaborative Analytical Studies*. The President referred to his correspondence with Dr. EGAN, Vice-President of the Applied Chemistry Division, on a proposal to call a meeting of those bodies, particularly those of international standing which sponsored collaborative testing, with a view to discussing a harmonization of approach and avoidance of duplication of effort. On the invitation of the President, Dr. EGAN confirmed the essence of his proposal and hoped that the Analytical Chemistry Division could take charge of the project.

(ii) *Publication of IUPAC Material in Open Literature*. There was strong feeling expressed that chemists in general had little idea of the work done by IUPAC and it was suggested that Commissions should be able to publish announcements of their programmes in the relevant specialist analytical journals. It was stated that there was a precedent for such action in that for many years, after a Conference, a summary of the Division's programme had been prepared and offered to journals of analytical chemistry. The response had varied, but a number of journals had at some time printed these summaries. It was suggested that Commissions could prepare summaries and, after approval by the Division President, send them to the Secretariat for submission to the editors of selected journals.

There was already a system whereby nomenclature reports could be published by journals of learned societies sponsored by IUPAC National Adhering Organizations. The Secretary was asked to circulate the exact conditions after consulting the Secretariat.

(iii) *Controversial Definitions of Terms and Units*. It was pointed out that some restrictive rules had been promulgated by international bodies with various consequences for some branches of science and it was asked that IUPAC should exert its influence to resist such restrictions. It was concluded that Members of IUPAC bodies should be on the alert for such measures and make representations through the Division President when the occasion arose.

(iv) *Division Secretary 1975*. The Secretary stated that his term of office expired after the XXVIII IUPAC Conference in 1975 and that he would not be eligible for nomination for a further term. Nominations for his successor would be sought, along with those of other Division Committee Members, during 1974.

APPLIED CHEMISTRY DIVISION COMMITTEE

21 and 27 August 1973

Present: Dr. R. W. CAIRNS (President), Dr. H. EGAN (Vice-President), Dr. W. W. MEINKE (Secretary), Prof. H. SUOMALAINEN, Dr. K. WEISSERMEL. The Chairmen and the Secretaries of the Sections of the Division were also in attendance, except Mr. MONKMAN, on 21 August. Dr. CAIRNS was unable to be present on 27 August, when Drs. COLLINGS and LANGLYKKE were in attendance.

1. Opening Remarks

The President welcomed the Members and Section Officers present and expressed regrets that, for health reasons, Dr. W. GALLAY (Past-President) had been unable to attend the meeting. He reported the death on 17 July of Dr. I. BOSUND, Committee Member from Sweden, and joined those present in expressing their condolences.

2. Minutes of Last Meeting

The Minutes of the Division Committee meeting held at Le Bischenberg, Strasbourg, on 20–21 September 1972, as recorded in the IUPAC *Information Bulletin* [No. 45 (May 1973), pages 36–42], were approved without change. Note was taken that the Division had exercised the right granted by the Bureau to the extent of using \$500 of 1972 residual Divisional Contingency Funds for the IUPAC-IUFoST Symposium on Contribution of Chemistry to Food Supplies in Hamburg (29–31 August 1973).

3. Division and Section Activities

The President pointed out that most of the detailed planning in IUPAC was done at the Section and Commission level, while the function of the Division Committee was one of policy and general overview. As part of a continuing reevaluation of the IUPAC organization, there had been a study of a possible reorganization of the Applied Chemistry Division. After numerous discussions a proposal was submitted to Council at its meetings on 21 and 23 July 1971 and was approved as recorded in Minute 14 (page 61 of *Comptes Rendus XXVI Conference*).

The approved reorganization as recorded in Minute 14 was as follows:

‘Since it was impractical for the Division to cover even a reasonable proportion of the important chemical technologies, it was deemed advisable to concentrate on problems relating to human welfare, particularly food and the environment. Six of the present Sections should be retained, though with changes in emphasis in some cases. A new Section was suggested to work on reclamation of solid wastes.’

Dissolution of the Sections on Organic Coatings (VI.6), and Pulp, Paper, and Board (VI.7) was proposed and, after considerable discussion, accepted by Council with the understanding that the Section on Organic Coatings . . . ‘continues its activities until the end of the XXVIIth Conference in order to finalize its work and to terminate the Section as part of the Division . . .’

The President emphasized that under the reorganization, Council and the Division expected the remaining Sections to broaden their programmes to

take full account of 'problems relating to human welfare, particularly food and the environment.' During the past two years the efforts of some Sections, such as those on Fermentation Industries and Food, had followed these directives very well. On the other hand, the work of the Water Quality Section continued to be restricted to only a portion of the efforts required under the reorganization, whilst the Air Quality Section had still to consider this matter in its future plans.

During 1972 there had been severe budgetary restrictions on the operation of the Division and it had fallen to the President to provide for the allocation of the limited funds without a clear cut priority list. The President chose to allocate the restricted funds on a basis of proportionality to the original budgets of the Sections. This was not an effective means of managing Division programmes. For the future, the President was enlisting the assistance of the Division Committee to help establish priorities of programmes among Sections, as well as to effect changes in Section programmes to bring them more into line with the present Division objectives.

Through the IUPAC Bylaws (4.1063), the Division Committee had been invested with the function of supervising 'the work of its Sections, Commissions and Sub-Commissions'. Also, it was responsible for proposing the establishment and dissolution of Sections, Commissions, and Sub-Commissions as well as the appointment of the Membership of these bodies. Furthermore, it was responsible for the budget of these individual bodies.

Therefore, in carrying out these responsibilities, the President planned to call on the Division Committee to play a much larger role in future in defining the problems with which the Division should be concerned. Furthermore, the President and Division Committee intended to ensure response to these directives to the Sections by the various means available to them, such as recommending (or not) proposed changes of Membership (including Officers), terminating or combining Sections, and/or modification of budget. The operating bodies of the Division must become responsive to the overall guidelines promulgated, after due discussion, by Council and the Division Committee.

4. Reports of Sections

The activities of the Sections and Commissions of the Division as well as their philosophy and mode of operation had been well recorded during the past two years. In *Comptes Rendus XXVI Conference*, the activities of Sections and Commissions of the Applied Chemistry Division for the period July 1969 to May 1971 were recorded (pages 42-46). In this same *Comptes Rendus* (pages 197-268) were recorded the efforts and plans of the Division and its component Sections and Commissions. IUPAC *Information Bulletin* No. 44 (December 1972) recorded the reports of the Sections between July 1971 and July 1972 (pages 23-25), while *Information Bulletin* No. 45 (May 1973) recorded a much more detailed report of objectives and future plans for the Division and for its Sections (pages 36-42). Finally, the Report of the President of the Applied Chemistry Division prepared for Council in Munich brought these earlier reports up to date.

Because this documentation was available at the meeting it was only necessary for each Section Chairman to make a short presentation of several salient features of the programme of his Section.

5. Elections

The Committee noted the election of four new Members at the Open Meeting of the Division on 26 August 1973 (see page 337), giving the Division Committee a full complement of ten Members. As noted at the Open Meeting, Dr. CAIRNS had offered his resignation, effective 1 September 1973, because of his candidacy for the Vice-Presidency of IUPAC. If this resignation was accepted by President BÉNARD, Dr. EGAN would automatically become President of the Division. Dr. CAIRNS would then succeed Dr. GALLAY on the Committee as Past-President. Dr. MEINKE had also submitted his resignation as Secretary, effective 1 September 1973, to permit the Division Committee to choose a Secretary geographically closer to Dr. EGAN. Dr. EGAN nominated Dr. A. J. COLLINGS for the position of Secretary of the Applied Chemistry Division and Dr. COLLINGS was elected with acclamation. Dr. EGAN drew attention to Bylaw 4.105 and nominated Prof. SUOMALAINEN and Dr. STOLL as Vice-Presidents of the Applied Chemistry Division. They were elected with acclamation.

6. Division Policy

Prof. SUOMALAINEN made a number of comments about Division Policy. He felt that the Division Committee should be concerned with the longterm development in the applied chemistry field. Members of the individual Sections and Commissions should be able to work independently within broad guidelines, but there must be good communication between the Division Committee and the Sections. The work of Sections should be activated but not necessarily curtailed. He felt that the Division Committee was the appropriate centre for contact with other international organizations to see that there was minimal overlap and that important areas of concern were covered. In addition, he felt that the Division Committee was the appropriate point of contact with Company Associates. He also wanted to be sure that throughout these times of reorganization and redirection that the significant work of the Division was activated rather than curtailed.

Dr. EGAN thanked Prof. SUOMALAINEN for his concern and described plans for the next year which would provide an opportunity for Section Chairmen to provide their input to the major problems currently facing the Division, e.g., diversification and environmental issues. Dr. EGAN proposed to set up two groups to study these problems. One would be concerned with the Environmental Area and he would be inviting Dr. FREYSCHUSS (coordinator), Mr. MONKMAN, Dr. ABBOTT, and Dr. MARCUSE (Chairmen of Sections on Water Quality, Air Quality, Pesticides, and Food, respectively), to consider and report before the 1974 Division Committee meeting with recommendations for dealing with environmental matters in IUPAC. Dr. EGAN had spoken with Prof. TANAKA (President of Analytical Chemistry Division) regarding liaison in this connection. The subject of solid wastes should also be considered. Dr. MEINKE would be concerned from the point of view of the Division Committee.

The second group would be set up to explore the problem of reactivation and diversification for the future programme development of the Division, chaired by Dr. LANGLYKKE and including Drs. VOS and Dr. KINOSHITA (Chairmen of the Oils and Fats Section and Fermentation Industries Section, respectively), together with Dr. STOLL and Dr. WEISSERMEL from the Division Committee. Prof. SUOMALAINEN, together with the President and the Past-President, would consider the reports independently before the 1974 Division Committee meeting, at which they would be then discussed. It was hoped also

that IUPAC Company Associates (or any nominated representatives of these) might meet the Division Committee immediately before the 1974 Division Committee meeting. Decisions made in 1974 could then be translated into major actions at the XXVIII IUPAC Conference in 1975.

The Committee also discussed the question of the structure of the Division, not only for 1975 but for 1977 and 1979, and it was proposed that individual Committee Members should be associated with the work of each Section and become an important communication link between the Division Committee and the Section, to explain policies and objectives of the Division to the Section Members, and also to learn in more detail than at present about the programmes of the Section and the rationale for these programmes.

8. Section Reports

The Committee received from the Sections short written reports of progress and statements of specific priorities for future work. These reports would appear in lengthened versions in *Comptes Rendus XXVII Conference*. Dr EGAN had raised, at the Open Meeting, the question of how, when necessary, Section budgets should be restricted. It was agreed that, provided the programmes were acceptable, this was best done on the basis of an equal proportional reduction for each Section.

9. Section Membership

Nominations for Titular and Associate Membership were received from the Sections, as their recommendations of Members they would need to carry out their new and reoriented programmes. The problems of nomination of new Members had been discussed with the Sections at the Open Meeting and emphasis had been placed on the need to diversify programmes when proposing new Members. With this as a background, the Division Committee agreed to recommend the nominations for Titular and Associate Membership to the Bureau, with the recommendation that all new Memberships be subject to review in two years, *i.e.*, in 1975. Note was taken that the Titular Membership of the Fats and Oils Section was almost exclusively from Western Europe. Note was also taken that the Organic Coatings Section ceased to be associated with the Applied Chemistry Division and was understood in the future to be organized as a Working Party of the Macromolecular Division.

10. Next Meeting

Note was taken that the preliminary budget for IUPAC in 1974 provided for one meeting of the Division Committee. It was proposed to schedule this meeting near the time of the Bureau Meeting and in Europe, probably in London or Brussels. This would be a two-day meeting and it was suggested that the Company Associates be invited to join the Committee during part of the first day or for the afternoon of the previous day.

SECTION ON FOOD (VI.1)

23-26 August 1973

Present: Dr. H. EGAN (Chairman), Dr. A. J. COLLINGS (Secretary), Dr. H. GUTHENBERG, Dr. E. O. HAENNI, Dr. K. KOJIMA, Dr. R. MARCUSE, Prof. J. F. REITH, Dr. A. E. WASSERMAN (Titular Members); Dr. H. FISCHBACH, Dr. P. L. SCHULLER, Prof. R. TRUHAUT (Associate Members); Dr. E. LÜCK, Dr. D. N. RHODES (National Representatives); Mr. D. F. DODGEN, Mr. E. A. WALKER, Prof. W. BALTES (Commission on Food Additives); Dr. N. R. JONES, Dr. P. KROGH, Dr. K. OHNO, Dr. I. F. H. PURCHASE, Prof. G. BILLEK, Dr. A. D. CAMPBELL, Dr. H. W. HOWARD, Prof. W. KRÖNERT (Commission on Food Contaminants); Dr. P. D. LAFLEUR, Dr. K. W. G. SHILLAM, Prof. S. RANGASWAMI (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting held at Küngälv during 23-25 August 1972 [see *Information Bulletin* No. 44 (December 1972), pages 55-59] had been circulated prior to the meeting. Dr. PURCHASE commented that Minute 5 should indicate that the mycotoxin check sample analysis scheme was one for which support was required. The minutes were duly approved. There were no other matters arising.

2. Chairmanship of Section

Dr. EGAN reminded Members that he had previously indicated that the election of the Chairman of the Food Section would be on the agenda of the present meeting. He was Vice-President and President-Elect of the Applied Chemistry Division, the President of which, Dr. CAIRNS, had submitted his resignation with effect from 1 September 1973. Both he and Dr. COLLINGS had, therefore, also tendered their resignations, to allow for an incoming Chairman and Secretary of the Food Section. Dr. EGAN proposed that Dr. MARCUSE be elected Chairman of the Food Section; this was seconded by Dr. HAENNI and approved unanimously. Dr. GUTHENBERG was elected Secretary for 1 year in the first instance.

3. Special Projects for Finding from Trusts and Foundations

The letter from the Executive Secretary (dated 18 May 1973) had been circulated to all Members of the Food Section. Dr. EGAN commented that already the Section was associated with the IUPAC-CEE contract arrangement for methods for food additives. There was need to improve contact with government and industry and several projects were suggested:

- (i) The international aflatoxin check sample assay scheme required financial support.
- (ii) Single cell protein specifications being produced in conjunction with the Fermentation Industries Section had contacts with only two companies at present.
- (iii) There was need to establish a satisfactory format for collaborative analytical studies.

(iv) It was possible that National Committees might suggest international problems in which IUPAC could assist.

(v) Dr. KROGH suggested that mycotoxin formation in foodstuffs on the high seas might be a suitable problem for special projects. It was agreed to refer the matter back to the Division for subsequent discussion with the Food Section. It was noted that UNIDO had a list of consultative organizations: it seemed appropriate to include IUPAC in this.

4. Matters introduced by Chairman

(i) Dr. EGAN reported that at the meeting of the Applied Chemistry Division Committee in Munich (see page 215) the questions of finance and programmes were discussed. The Division Committee would be taking a closer interest in the programmes and Membership of its Sections. The budget would be controlled at Division Committee level. In future this would be done much more critically with close reference to the work programme of the Sections. The present work of the Food Section was analytically orientated and he thought there were problems in other areas to which a more positive approach was needed. Not only health protection problems had to be solved, but there were also problems of quality, availability, and acceptability of food, which could be included in the programme of the Food Section. He suggested to Members that the aim should be to revise the programme of the Section by 1975. To do this it might be best to put all the analytical methodology into a single Commission, then to orient the second Commission with broader areas of interest covering such things as food quality, synthetic contributions to food, and methods of assessing the quality and keepability of natural products.

(ii) Regarding liaison with other Sections, Dr. EGAN reported that joint meetings had been held in Munich with the Fermentation Industries Section, Oils and Fats Section, and Pesticides Section, and also with the Commission on Analytical Reactions and Reagents of the Analytical Chemistry Division (see pages 226, 228, 230, and 224, respectively). He welcomed liaison with other IUPAC bodies and thought this was essential in order to minimize duplication of effort.

5. Liaison with IUFOST

Dr. MARCUSE commented that in the past 2 years since IUFOST had been created, there had been some interesting developments. Originally, it was thought that there could be problems due to overlap of interest, but it was now clear that there would not and there was every encouragement for good working relationships between the two Unions.

The attendance expected at the IUPAC-IUFOST Symposium on Contribution of Chemistry to Food Supplies (Hamburg, 29-31 August 1973) was disappointing since to date only some 220 people had registered. However, it was recognized that many symposia were experiencing difficulty in obtaining a satisfactory number of participants. The meeting took the opportunity to put on record its thanks to Dr. EGAN, Dr. COLLINGS, Prof. BILLEK, and Dr. MARCUSE for the work they had done in arranging the IUPAC-IUFOST Symposium. Dr. EGAN said that there would be a formal joint liaison meeting in Hamburg on 28 August 1973.

Dr. EGAN reported that the XXV IUPAC Congress would be held in Jeru-

salem in 1975, and that the programme was very much aligned to that of the Applied Chemistry Division. Prof. Y. MARCUS and Dr. J. A. EPSTEIN of the Organizing Committee were present in Munich and had indicated that one of the proposed topics was 'Food Resources through Chemistry': Members of the Food Section were invited to submit detailed suggestions for inclusion in it.

6. IUPAC-CEE Contract

The report on methods for the 1973 contract, prepared by Prof. F. PELLERIN (Secretary, Coordinating Committee), had been circulated prior to the meeting and had been discussed in Munich jointly with Members of the Commission on Analytical Reactions and Reagents. Dr. SCHULLER raised some points on the procedure for selection and clearance of the methods, with particular reference to the practical evaluation of methods proposed. Subject to some alterations (including the practical evaluation of methods where necessary) suggested principally by Dr. SCHULLER, it was agreed that the methods could go forward. A Working Group, comprising Dr. EGAN, Dr. SCHULLER, Prof. REITH, and Dr. COLLINGS, met separately and proposed a revised scheme for the selection of methods and their evaluation for future IUPAC-CEE contracts. The Section noted the absence of any feedback from CEE on the acceptability of the methods being submitted by IUPAC, and expressed the hope that this would be discussed at the proposed meeting in Brussels in November 1973.

7. Relations with International Agencies

The Secretariat continued to give notice to the Section Officers of various WHO and FAO technical reports of interest as they were published. It was agreed to broaden the basis of distribution of these documents where possible. The Protein Advisory Group (PAG) of the United Nations was still interested in methodology for available lysine and purines in food. However, it was thought that the Food Section could not at present make any recommendation for such methods. A need was identified for rapid screening and reference methods for determination of the nucleic acid content of single cell protein and also for sulfur amino acids. It was noted that the PAG document referring to mycotoxins should draw attention to the work of the Food Section in this area. The benzo(a)pyrene method proposed for single cell protein had been accepted, but there was a pH precipitation problem which would be attended to by Dr. HAENNI. A report from IARC, prepared by Mr. WALKER, had been circulated to Members, indicating that an agreed method for detection of nitrosamines in canned meats at the level of parts per thousand million was available. The Section noted that Dr. F. PARISI had been appointed as representative of IUPAC for liaison purposes with ICC. ISO had also sent methods to IUPAC for consideration; the Chairman of the Food Section had made these available to selected Members and it was agreed that this circulation should also be widened if possible.

8. Structure of Section and its Commissions

Dr. EGAN reminded Members that the Applied Chemistry Division Committee intended to take a fuller interest in the Section programme, and also to play a more positive role in recommendations to the Bureau for Titular Membership in relation to programmes. Dr. JONES had presented a report in 1972 identifying new areas of work. It was necessary now to establish work

in these or similar areas of interest and to run down the analytical aspects of the Section or transfer them to the Analytical Chemistry Division. This would give more room for positive aspects of the quality control, compositional analysis, and quality criteria of food. It was suggested that all the work on trace analysis should be brought into a single Commission by 1975. Also, it was suggested that the work of the Section and its two Commissions could be extended by the appointment of National Representatives by the individual National Committees for Chemistry. Several suggestions were made for other areas of work for the Food Section, such as the spoilage and shelflife of natural products, chemical indexes of nutrition, and problems of spice quality (clove, cinnamon, vanilla) and citrus juices. Dr. CAMPBELL commented that many of the areas were too vague and there was need to narrow them down. Dr. MARCUSE suggested that a pilot study should be established to look into rapid methods for quality criteria, and Dr. FISCHBACH suggested that there might be a similar investigation into methods for detecting the misrepresentation of food.

9. Programme 1973-5

Dr. EGAN referred to the reports from the two Commissions. The question of harmonization of collaborative studies was being considered by the Analytical Chemistry Division. The report on solvent specification had been finalized by Dr. COLLINGS and, subject to final comments from Members, would be presented for publication as a Technical Report appendix to the *Information Bulletin*. It was agreed that methods for the estimation of tin in inorganic and organic form and of zinc in food should be reviewed in 1974.

A review Dr. RHODES had been preparing on the detection of feed additives in meat was discussed. It was agreed that this review should be revised in the light of comments made. The determination of diethyl stilbestrol was also discussed: Dr. SCHULLER indicated that methods were now available for detection and estimation in flesh at $\mu\text{g/Kg}$ levels.

10. Publications

A joint IUPAC-AOAC study by HOWARD, FANZIO, and WHITE on benzo(a)-pyrene in smoked food had been published [*J. Assoc. Offic. Anal. Chem.* **56**, 68 (1973)]. The collaborative study on stability of aflatoxin M_1 standards had been issued as Technical Report appendix No. 6 to the *Information Bulletin* (November 1972), and the collaborative study on aflatoxin M_1 in milk was in the process of publication, as was the corresponding study for copra, copra meal, and coconut. Further papers on coco beans and sampling were under consideration. A review on the determination of cadmium in food by Dr. COLLINGS would also be issued as a Technical Report.

11. Membership

The Section reviewed the Memberships of the Section and its two Commissions and proposals for 1973-75 were forwarded to the Division Committee for Bureau approval.

12. Commission Reports

The Food Additives Commission and the Food Contaminants Commission presented reports to the Section. The Food Additives Commission had considered methods for polynuclear aromatic hydrocarbons in food and had

participated in the nitrosamine ring test programme. It was also initiating a multicomponent antioxidant collaborative study for food. The Food Contaminants Commission had carried out work on the estimation of total mercury in a fish base and had revised the 1965 IUPAC lead procedure. The report on cadmium would be published, from which an acceptable method could be agreed. Copper, selenium, and fluoride continued to be of current interest. Problems of mycotoxins had also been extensively studied and work continued on single cell protein in association with the Fermentation Industries Section.

Several suggestions were put forward as special projects for finding from trusts and foundations. These included standardization and destruction of organic matter, determination of vegetable protein in meat products, and collection of available data on contamination in diet.

13. Date and Place of Next Meeting

The offer of Prof. A. RUTKOWSKI to make arrangements for a meeting of the Section and its Commissions in Poland (Warsaw) was warmly accepted, the hope being expressed that the meeting could be preceded by a further symposium on mycotoxins (Pulawy).

Joint Meeting of Section on Food (VI.1) and Commission on Analytical Reactions and Reagents (V.1)

22 August 1973

Present: Dr. H. EGAN, Dr. A. J. COLLINGS, Dr. H. FISCHBACH, Dr. H. GUTHENBERG, Dr. E. O. HAENNI, Dr. K. KOJIMA, Dr. R. MARCUSE, Prof. J. F. REITH, Dr. D. N. RHODES, Dr. P. L. SCHULLER, Dr. A. E. WASSERMAN (VI.1); Prof. R. BELCHER, Prof. F. PELLERIN, Dr. J. BARTOS, Dr. M. HARMELIN, Dr. A. HULANICKI, Prof. J. INCZÉDY, Prof. S. IKEDA, Dr. M. KAPEL, Dr. M. PESEZ, Mr. F. J. REIDINGER, Prof. S. SIGGIA, Prof. H. WEISZ (V.1); Prof. W. BALTES, Mr. D. F. DODGEN, Dr. H. W. HOWARD, Prof. W. KRÖNERT, Dr. S. J. KUBACKI, Dr. P. D. LAFLEUR, Dr. K. OHNO, Mr. E. A. WALKER (Observers).

1. Dr. EGAN welcomed the participants to the joint meeting, which had originally been called to take care of the work on the IUPAC-CEE contracts. He also invited comments and help in other analytical areas of common interest.

2. The minutes of the meeting held on 17 July 1971 in Washington, DC (*Comptes Rendus XXVI Conference*, pages 207–208), were approved.

3. Prof. PELLERIN reported that the 1972 methods had been sent to CEE in November and the 1973 methods had already been circulated to Members of Section VI.1 and Commission V.1 for comment. Most of the definitive comments had been incorporated in his report and the next stage was for the English text to be revised editorially by Drs. COLLINGS and KAPEL and the French text by Prof. PELLERIN.

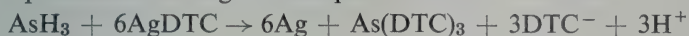
4. Concerning arrangements for the 1974 Contract

4. Concerning arrangements for the 1974 contract, the need was clearly identified for a joint meeting between IUPAC and CEE. Little response had been received from CEE. Prof. TRUHAUT had attempted to make contact, but had been unsuccessful. Prof. BELCHER expressed regret at the great delay in CEE approval of the methods already submitted by IUPAC; it would be of great help to hear of any criticism as early as possible. Also, it was considered necessary that CEE should reassess some of the specifications proposed. It was suggested that Dr. SCHULLER, Dr. EGAN, Dr. COLLINGS, and Prof. REITH should meet in Munich and attempt to expedite matters: as a result a revised mechanism for the selection of methods was proposed. Dr. EGAN took the opportunity to inform Members of the Analytical Reactions and Reagents Commission of the analytical aspects of the work of the Food Section. Much of the work was involved with trace analysis, although the work was expanding in nonanalytical areas. The Food Section had recommended methods for lead, mercury, and copper in food in 1961 and these now required updating. Also, the Section was active in the areas of nitrosamines, mycotoxins, cadmium, polycyclic aromatics, and food solvents specifications. In all these areas there were requirements for criteria for the standard of purity and for analytical content.

5. Prof. BELCHER commented on the need to revise old methods. Often the methods used straight optical turbidity comparisons, whereas for more reliable results one could use a low cost nephelometer. Dr. EGAN mentioned that much work was in progress on collaborative studies on analytical methods, but no coordination was present. It was agreed that a symposium on the

harmonization of collaborative studies was desirable. This had the support of the Presidents of the Applied and Analytical Chemistry Divisions.

6. Prof. BELCHER enquired as to the principles behind the silver diethyldithiocarbamate method for arsenic. Dr. HULANICKI stated that he had looked into this and found that it did depend on the formation of colloidal silver. He said that the reaction between arsenic and silver diethyldithiocarbamate had been investigated (BODE *et al.*, HULANICKI and GTAB) and on the basis of stoichiometry, TLC, and correlation to other similar systems, it had been found to proceed according to the equation:



The arsenic(III) diethyldithiocarbamate complex was pale yellow and contributed insignificantly to the total absorbance of the solution. The species responsible for the colour and therefore the analytical usefulness of the reaction was the colloidal silver dispersion. The reaction mentioned above proceeded in the presence of a proton acceptor. The formerly used pyridine, being at same time a solvent (VASAK and SEDIVEC), had been replaced recently for reasons of toxicity and unpleasant smell by chloroform as solvent with addition of ethanolamine (as proton acceptor) (HULANICKI and GTAB). The effect observed in some instances, that different batches of silver diethyldithiocarbamate reagent influenced the absorption, was explained by the catalytic action of impurities on silver reduction as well as by the fact that ionic silver present might undergo easier reduction, giving as a final product colloids of various particle size. Antimony interfered and the quality of the reagent could affect the colloidal form of the reaction products and alter the absorption maximum. This was confirmed by Dr. SCHULLER.

Joint Meeting of Section on Food (VI.1) and Section on Fermentation Industries (VI.2)

22 August 1973

Present: Dr. H. EGAN, Dr. A. J. COLLINGS, Dr. H. FISCHBACH, Dr. H. GUTHENBERG, Dr. E. O. HAENNI, Dr. K. KOJIMA, Dr. R. MARCUSE, Dr. J. F. REITH, Dr. D. N. RHODES, Dr. P. L. SCHULLER, Dr. A. E. WASSERMAN (VI.1); Dr. A. LANGLYKKE, Dr. S. KINOSHITA, Dr. J. C. HOOGERHEIDE, Mr. W. K. BRONN, Dr. R. J. ERTOLA, Prof. A. FIECHTER, Prof. I. HORVÁTH, Dr. B. M. LAINE, Dr. F. PARISI, Prof. S. J. PIRT, Dr. L. STONE, Prof. H. SUOMALAINEN (VI.2); Dr. A. D. CAMPBELL, Mr. D. F. DODGEN, Dr. H. W. HOWARD, Dr. N. R. JONES, Dr. M. KANAZAWA, Prof. W. KRÖNERT, Dr. S. J. KUBACKI, Dr. K. OHNO, Dr. K. W. G. SHILLAM, Dr. F. TANAKA, Mr. E. A. WALKER (Observers).

1. Dr. LANGLYKKE (Chairman of the Fermentation Industries Section) invited Dr. EGAN to take the Chair. The agenda prepared by Dr. HOOGERHEIDE together with the minutes of the joint meeting held in Washington, DC, on 15 July 1971 (*Comptes Rendus XXVI Conference*, page 208) were approved.

2. Dr. EGAN said that there was a need to clarify the application of the draft specifications proposed for single cell protein (SCP) by the Fermentation Industries Section. Although they were based on PAG publication No. 6 (human nutrition), the specifications were primarily for use for animal feed. Proposals for methods for the enforcement of the specifications were then circulated and examined by the meeting.

3. *Moisture Content.* The method of BRANDON (drying at 100° for 16 hours) was accepted.

4. *Ash Content.* After discussion it was agreed that ashing at $600 \pm 10^\circ$ would be suitable and minimize problems associated with the fusing of the sample.

5. *Lead.* The 1965 IUPAC method had been reviewed and would be revised by the Food Section. It was thought that the AOAC method [*J. Assoc. Offic. Anal. Chem.* **55**, 424 (1972)] with an atomic absorption finish would be acceptable, but any method selected would have to be evaluated on a number of test substrates.

6. *Arsenic.* It was agreed that the silver diethyldithiocarbamate version of the AOAC method was preferred to the one previously recommended.

7. *Mercury.* Dr. GUTHENBERG told the meeting that an IUPAC method based on an atomic absorption finish was being evaluated and appeared to be acceptable for total mercury in fish. It was agreed to make the method available to the Fermentation Industries Section.

8. *Total Nitrogen.* Two methods were considered. After discussion it was agreed to accept the macro method but with a 5-hour digestion time in order to allow complete mineralization of the sample. It was agreed that the standard acid should be standardized by ammonium sulphate followed by the complete distillation process.

9. *Nucleic Acid Nitrogen.* This matter was under discussion by the Food Contaminants Commission. It was agreed that it would be dangerous to generalize, because different sources of SCP had different compositions and

properties. It was thought that the ERSKINE method, with variations for different substrates, could be recommended.

10. *Ammonia and Urea*. The proposed BRANDON method was accepted.

11. *Lysine and Available Lysine*. Dr. LAINE commented that the CARPENTER method was not acceptable. This was supported by Dr. JONES who said that the ROACH method could be used: a cautionary note regarding the CARPENTER method was desirable.

12. *Sulfur Amino Acids*. The Food Additives Commission was considering this method. It was thought that the MOORE method had the minimum number of limitations.

13. *Crude Lipids*. It was agreed to redefine this as crude fat.

14. *Pepsin Digestibility*. The general method proposed related to a wide range of substrates. There was a need to specify individual procedures based on practical evaluation for each protein, although the general approach appeared to be acceptable.

15. *Protein Efficiency Ratio*. The AOAC method appeared to be acceptable.

16. *Polycyclic Aromatic Hydrocarbons*

Benzo(a)pyrene. The HOWARD-FANZIO-WHITE method was considered acceptable, but there was a need to control the pH in the initial digestion stage. Dr. HAENNI agreed to provide additional data on this matter.

RNA and DNA. Prof. PIRT enquired whether a simple test of RNA or DNA content would assist the identity of SCP. However, the simple methods available were not very specific.

Mycotoxins. Dr. FISCHBACH commented on the need for mycotoxin control in SCP. Dr. LANGLYKKE replied that using well identified microorganisms, the problem would not arise. The standards provided that no toxic organisms might be used for SCP.

17. *Liaison*. It was agreed that future liaison should continue between the Officers of the two Sections and that a further joint meeting would be arranged at the XXVIII IUPAC Conference in 1975.

Joint Meeting of Section on Food (VI.1) and Section on Oils and Fats (VI.3)

24 August 1973

Present: Dr. H. EGAN, Dr. A. J. COLLINGS, Dr. H. FISCHBACH, Dr. H. GUTHENBERG, Dr. E. O. HAENNI, Dr. K. KOJIMA, Dr. R. MARCUSE, Dr. D. N. RHODES, Dr. P. L. SCHULLER, Dr. A. E. WASSERMAN (VI.1); Dr. E. HEINERTH, Drs. H. J. VOS, Dr. N. D. EMBREE, Dr. G. LOEW, Dr. K. A. WILLIAMS (VI.3); Prof. T. ASAHARA, Prof. G. BILLEK, Dr. A. D. CAMPBELL, Dr. J. A. CORNELIUS, Prof. E. L. DELVAUX, Drs. P. W. HENDRIKSE, Dr. H. GALENKAMP, Dr. J. GRACIAN-TOUS, Dr. E. KURUCZ, Dr. Ö. LEVIN, Dr. P. R. E. LEWKOWITSCH, Mr. A. T. MÖLLER, Prof. R. MONACELLI, Prof. M. NAUDET, Prof. H. NIEWIADOMSKI, Dr. K. OHNO, Prof. C. PAQUOT, Dr. J. POKORNÝ, Prof. A. RUTKOWSKI, Mr. E. A. WALKER, Drs. J. C. VAN DER WEEL, Dr. H. H. R. H. WENDT (Observers).

1. At the invitation of Dr. EGAN, Dr. HEINERTH (Chairman of Oils and Fats Section) took the chair of the meeting and welcomed the Members of the two Sections. The agenda prepared for the meeting was agreed.

2. *Antioxidants.* The Oils and Fats Section was in the process of evaluating two analytical methods for the detection and determination of antioxidants in fats. One method was qualitative, based on thin layer chromatography (TLC); the other was for BHA and BHT and based on gas-liquid chromatography (GLC). For tocopherols the Oils and Fats Section was looking into a colorimetric and a GLC method, but an insufficient number of results were available to make recommendations. The TLC method had been accepted. Dr. HAENNI (Chairman of the Food Additives Commission) told the meeting that his Commission was looking into the need for multicomponent antioxidant determination in food. It was well understood that analysis of fat *per se* often required specialized techniques. Dr. EGAN drew attention to the report of the Food Section on 'Survey of Analytical Methods Available for Estimation of Some Food Additives in Food' published in *Pure and Applied Chemistry* [26, 75 (1971)]. It was thought desirable for the methods for antioxidants in this report to be updated. Dr. HAENNI agreed to do this. There was also a need to review analytical methods for the newer synthetic antioxidants.

3. *Essential Fatty Acids.* It was of great importance in the margarine and edible fats area that the levels of linoleic acid be known. The Oils and Fats Section was studying methods available, one of which was based on GLC for the determination of C-18 fatty acids and the other of which used lipoxylase which was specific for *cis-cis* methylene interrupted fatty acids (*cis-cis* 9,12-linoleic acid). However, it was recognized that other *cis-cis* polyunsaturated acids, such as linolenic and arachidonic acids, and isomers of linoleic acid, would interfere in the lipoxylase method.

4. *Trans-Fatty Acids.* A method had been accepted for the determination of *trans*-fatty acids in oil for human consumption. It was based on thin layer chromatography followed by gas-liquid chromatography. An infrared method would also be studied.

5. *Trace Metals.* The Oils and Fats Section expressed an interest in trace metal contamination for both toxicological and technological considerations

(30 µg/Kg of copper impaired the keeping quality of oil). The Food Section was updating its earlier methods for lead, mercury, and copper in food. A ring test had been organized by the Food Contaminants Commission and a revised method for lead would be submitted to a collaborative study, although the substance to be used had not yet been decided. The Oils and Fats Section was very interested in the methodology, but recognized that digestion procedures for oils and fats were not always suitable for foods in general: in some cases oils and fats could be examined by atomic absorption spectrophotometry without preliminary digestion. Dr. SCHULLER commented that it was hoped that the methods being developed in the Food Section would be general methods. It was agreed to make available the methods for mercury and lead.

Other organizations had also studied the problems of fat digestion, but it had been found that copper, tin, lead, zinc, and probably nickel rapidly entered acid aqueous solution. Methods for cadmium, copper, nickel, and iron in edible oils had been evaluated by AOCS [*J. Amer. Oil Chem. Soc.* **49**, 431A (1972)]. The Food Contaminants Commission had prepared a review of methods for cadmium in foods and Dr. KOJIMA reminded the meeting that the Pesticides Section were working on methodology for methyl mercury in fish.

6. *New Methods for Oils and Fats.* Drs. Vos informed the meeting that the compendium of methods on oils and fats would have its third supplement published soon and that some 10 further methods were under consideration by the Oils and Fats Section. Dr. EGAN reported that a symposium on the harmonization of collaborative studies on analytical chemistry would be considered at the meeting of Presidents later in the present Conference. It was agreed to exchange annual reports of the respective Sections and to make provision for another joint meeting in 1975.

Joint Meeting of Section on Food (VI.1) and Section on Pesticides (VI.5)

22 August 1973

Present: Dr. H. EGAN, Dr. A. J. COLLINGS, Dr. H. FISCHBACH, Dr. H. GUTHENBERG, Dr. E. O. HAENNI, Dr. K. KOJIMA, Dr. R. MARCUSE, Dr. D. N. RHODES, Dr. P. L. SCHULLER, Dr. A. E. WASSERMAN (VI.1); Dr. D. C. ABBOTT, Dr. P. SLADE, Dr. K. FUKUNAGA, Dr. K. R. HILL, Dr. H. HURTIG, Prof. P. E. KOIVISTOINEN, Dr. CH. RESNICK (VI.5); Dr. A. D. CAMPBELL, Dr. H. FREHSE, Dr. H. W. HOWARD, Prof. W. KRÖNERT, Dr. K. OHNO, Mr. E. A. WALKER (Observers).

1. Dr. EGAN invited Dr. ABBOTT (Chairman of the Pesticides Section) to take the chair. The agenda was accepted and the minutes of the joint meeting between the Pesticides Section and the Food Additives and Contaminants Commission held in Washington, DC, on 15 July 1971 (*Comptes Rendus XXVI Conference*, pages 216-217) were noted. Dr. ABBOTT commented that the area of common interest between the two Sections was largely that of trace metal contamination.

2. *Mercury.* The problems of analyzing total and organically-bound mercury were discussed. Dr. MARCUSE reported that the Food Contaminants Commission had produced on improved IUPAC total mercury method, which had been evaluated in a collaborative study in 8 laboratories, using a Canadian-supplied fish sample containing known amounts of mercury. The results had been satisfactory and consistent with those reported in other collaborative studies. The meeting recorded that AOAC-SAC, EPA, and Dr. SHAPIRO (IAEA), as well as IUPAC, had organized studies on mercury in food. It was identified that in many studies there were sampling problems and there appeared to be changes in the availability of mercury in some samples with time. Organically-bound mercury continued to be a problem of interest and the Pesticides Section was recommending the use of gas chromatographic methods. There was still a considerable amount of interest in mercury, both total and the proportion in organic form, both difficult problems.

3. *Lead.* The Pesticides Section was no longer particularly interested in lead. The Food Contaminants Commission had revised the IUPAC lead method but there might be a need for it to be verified experimentally.

4. *Cadmium.* Cadmium was also of little interest to the Pesticides Section. The Food Contaminants Commission had produced a review on cadmium in food which would be published. Also, FAO-WHO and MAFF had produced publications on cadmium. It was hoped that the Food Contaminants Commission would be able to recommend a method for cadmium in food. The problem of cadmium in zinc (up to 1%) was considered and noted. Also, there was increasing interest in cadmium in sewage sludge, which could be applied to agricultural land and thus enter the food chain.

5. *Copper.* The Pesticides Section was not active in this area but it was considered a useful area of discussion between the Food and the Oils and Fats Sections.

6. *Tin*. The Pesticides Section was interested in triphenyl- and tricyclohexyltin as pesticide residues and it was thought desirable to produce a review on methodology for tin in food.

7. *Other Areas of Interest*. Dr. HURTIG commented on the need for reliable methods for trace metals in sewage sludge and fertilizers which could enter the food chain. The Pesticides Section had PCBs on its agenda, because they continued to be an analytical and an interference problem. Dioxins were considered to be a technical problem and if due care was taken at the formulation stage, no problem should arise. Also, ethylene oxide residues were identified as being an area to be kept under review.

8. It was agreed to arrange a further joint meeting in connection with the XXVIII IUPAC Conference in 1975. The meeting noted that the Pesticides Section had organized the III International Congress on Pesticides for Helsinki in July 1974 and the Food Section the Symposium on Contribution of Chemistry to Food Supplies at Hamburg in August 1973.

COMMISSION ON FOOD ADDITIVES (VI.1.1)

23-25 August 1973

Present: Dr. E. O. HAENNI (Chairman), Dr. A. E. WASSERMAN (Secretary), Prof. G. GRIMMER (Titular Members); Mr. D. F. DODGEN, Dr. S. J. KUBACKI, Mr. E. A. WALKER (Associate Members); Prof. W. BALTES (National Representative); Dr. P. D. LAFLEUR, Dr. E. LÜCK, Dr. E. MERGENTHALER, Dr. MÖHLER, Dr. D. N. RHODES, Dr. G. VETTORAZZI (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting in Küngälv on 23-25 August 1972 [see *Information Bulletin* No. 45 (May 1973), pages 22-24] were approved.

2. Current Programme Reports

(i) Mr. WALKER reported on the progress of the collaborative nitrosamine assay being conducted through IARC. The first phase had been completed. This consisted of circulating standard solutions of *N*-nitrosodiethylamine and *N*-nitrosopyrrolidine for analysis by the techniques in use in the collaborator's laboratory. The results of the 16 respondents, who analyzed 10 mg/l. with variation of $\pm 10\%$ were reported at Küngälv. The second phase of the study was in progress. Pork luncheon meat obtained from a commercial source was spiked with *N*-nitrosodiethylamine, -dimethylamine, -dibutylamine, and -pyrrolidine, then canned and autoclaved. Collaborators were instructed to use the full can for analysis, with choice of method of analysis optional. To date 7 of 16 laboratories had responded. At 20 $\mu\text{g}/\text{kg}$ the recoveries ranged up to about $\pm 50\%$. Mr. WALKER was encouraged by the results and would have the completed statistical analysis as soon as possible. This report was accepted with some discussion of methodology and collaborative assay procedure.

(ii) Dr. HAENNI brought up the status of the HOWARD multicomponent polycyclic aromatic hydrocarbon analysis procedure. This had not been published by IUPAC, and the record was not clear at this time whether release from *J. Assoc. Offic. Anal. Chem.* had been obtained, as Dr. HAENNI suggested through Dr. COLLINGS. Subsequently, Dr. HAENNI determined that the report would not be republished.

(iii) Prof. GRIMMER reported on a new gas chromatographic procedure for the analysis of polycyclic aromatic hydrocarbons (PAH). Mixtures of 11 PAH could be separated and determined in 2-3 hours based on simultaneous multisample analysis. He presented a scheme for separation of PAH from meat, poultry, fish, and yeast, and results of extractions from spiked smoked sausage and meat. An OV-101 column was used with benzo(b)chrysene for internal reference purposes. Approximately 10 analyses could be made in a 5 work-day period per analyst. During the discussion it was brought out that this method was more rapid and more sensitive than spectroscopic procedures, such as the HOWARD procedure, but the question of the identity of the peaks was raised. The possibility of having to confirm positive results with the mass spectrometer, or by checking analysis, *e.g.*, by the HOWARD procedure, was recognized. Prof. GRIMMER was requested to initiate and carry out a collaborative study of his procedure. He agreed to do this and have the results available for the next meeting of the Commission. Dr. HAENNI requested

Prof. GRIMMER to submit an outline for the study to Dr. WASSERMAN for review by Commission Members prior to initiation of the study.

(iv) Dr. MÖHLER submitted an updated report on the methods of analysis of nitrosatable amines in food products. New information included a report from Dr. SANDER's laboratory, using the technique of ITO *et al.* for converting amines into nitrosamines for analysis. In Dr. MÖHLER's laboratory a copper sulfate method gave good total amine values. Following discussion of this report, Dr. HAENNI indicated that the sense of the Commission at this time was not to recommend a procedure for analysis for amines in general, because there was no present need for such an official method, but to encourage publication of the survey as a reference source for those interested in analysis for amines. The Secretary would contact Prof. BELITZ about the advisability of revising and publishing the report. The Commission would discontinue consideration of this subject in the absence of a demonstrated need for determination of a specific amine in food.

(v) Dr. RHODES submitted a status report on the determination of nitrite and nitrate in meat and meat products. He drew attention to the fact that the terms 'meat' and 'meat products' were used indiscriminately in titling the procedures; this fact was important because components of the material assayed would affect the recoveries of nitrite. Dr. RHODES indicated that the extraction of nitrite from the meat matrix should be done under alkaline conditions to suppress interference from ascorbic acid. Treatment with activated charcoal might be desirable to eliminate or to minimize ascorbic acid interference in the determination of nitrite. For the determination of nitrate, reduction to nitrite by passage through a cadmium column appeared to be adequate at this time. Dr. RHODES suggested that, in view of the lack of validity of the various standard methods, a collaborative assay using any of these procedures was not practical at present. He proposed preliminary tests of extraction procedures by selected laboratories on a variety of meat products and by several procedures to establish methodology to be submitted for collaborative analysis. Also, he proposed that other organizations preparing 'standard' methods, such as AOAC, CEE, ISO, SAC, and the Scandinavian group, be made aware of this exercise and invited to participate.

(vi) Dr. KUBACKI reported that his survey on the multicomponent antioxidants analytical procedures would be completed by November and he would submit it to the Secretary for distribution. Consideration for collaborative analysis in coordination with the programme of the Oils and Fats Section would be requested at the next Commission meeting.

(vii) Prof. BALTES discussed the status of the analysis of urethane from diethylpyrocabonate. Very few procedures were available. The best, in Prof. BALTES' opinion, was that developed by Bayer AG analysts. However, the method had not yet been published. Dr. HAENNI had been in contact with Dr. PAULI concerning clarification of some points but no further word had been received. Prof. BALTES agreed to determine the status of the Bayer method. If it was not adequate, he would follow up with studies in his laboratory.

3. New Programmes

The question of new programmes was discussed and several suggestions were made.

(i) *Drug Residues in Food Products*. Dr. RHODES informed the Commission that he had been requested to prepare a report on residues of feed additives in meat products for the Food Section. Copies were made available to the Commission. Accordingly, this subject was a Food Section programme item.

(ii) *Artificial Sweeteners*. This topic had been assigned to Dr. A. EDHBORG for a survey of the procedures available, but no report had been received. Dr. HAENNI would contact Dr. EDHBORG about this matter.

(iii) *Other Problems*. Mr. DODGEN suggested that low molecular weight degradation products of carrageenan might be a problem and the usual viscosity test might not be an adequate analytical procedure. On behalf of Prof. H. D. BELITZ, Dr. MERGENTHALER distributed a report on the analysis of thickening agents. Because it was in German, it could not be discussed immediately. He would supply a translation and relevant references. Dr. MERGENTHALER suggested that discussion be postponed until the next Commission meeting. Other projects discussed included the question of analysis for asbestos in talcs and silicates used in foods, which was proposed by Mr. DODGEN. Dr. HAENNI also suggested carcinogenic heterocyclic polycyclic hydrocarbons as possible problems for investigation.

4. Special Projects

The IUPAC Secretariat had requested proposals for appropriate projects which might be attractive to industry, government, agencies, trusts or foundations for financial underwriting. Dr. HAENNI suggested that the costly resources expended in duplicate or overlapping collaborative studies might stimulate such support for a proposed 1975 symposium. The latter was intended to harmonize and coordinate the many such studies instituted by diverse international and national organizations with compatible objectives.

5. Date and Place of Next Meeting

The next meeting would be in conjunction with that of the Section on Food, tentatively scheduled for July 1974 in Warsaw.

COMMISSION ON FOOD CONTAMINANTS (VI.1.2)

23-25 August 1973

Present: Dr. R. MARCUSE (Chairman), Dr. H. GUTHENBERG (Secretary), Dr. N. R. JONES, Dr. P. KROGH, Dr. K. OHNO, Dr. I. F. H. PURCHASE (Titular Members); Prof. G. BILLEK, Dr. A. D. CAMPBELL, Dr. H. W. HOWARD (Associate Members); Prof. W. KRÖNERT (National Representative); Dr. A. J. COLLINGS, Dr. K. KOJIMA, Prof. J. F. REITH, Dr. P. L. SCHULLER, Dr. P. S. STEYN, Prof. R. TRUHAUT, Mr. E. A. WALKER (Observers).

1. Minutes of Previous Meeting

The minutes of the meeting held at Küngälv during 23-25 August 1972 [see *Information Bulletin* No. 45 (May 1973), pages 25-28] were accepted.

2. Membership

It was proposed that the Commission should be composed of experts on trace analysis of heavy metals, mycotoxins, and single cell protein. Dr. MARCUSE, due to his election as incoming Chairman of the Food Section, resigned from his Chairmanship of the Commission and Dr. KOJIMA agreed to take over this commitment. Dr. GUTHENBERG, Secretary of the Commission, due to his election as incoming Secretary of the Food Section, likewise resigned and Dr. KOJIMA proposed Dr. OHNO as his successor. Dr. OHNO agreed. Prof. L. ACKER (National Representative of the Federal German Republic) had resigned and been replaced by Prof. KRÖNERT.

3. Matters Introduced by Chairman

A report on the activities of the Commission since the meeting at Küngälv had been distributed to Members. The round table discussion on 'Mycotoxins: Natural Occurrence and Control Measures', which took place at Küngälv, had been published and was available on request from Dr. MARCUSE.

A letter had been received from Mr. K. STISTRUP (Chairman of the Technical Committee of the recently founded 'European Food Emulsifier Manufacturers' Association), expressing EFEMA's interest to cooperate with respect to methods of analysis for food additives, especially emulsifiers.

4. Determination of Mercury in Food

Work on determination of traces of mercury in food with an alternative atomic absorption spectroscopic (AAS) finish to the IUPAC method published in 1965 had been continued. Drs. GUTHENBERG and SCHULLER had collaborated in elaborating such a method. A draft description of the method was available on request. Samples of dried fish muscle had been distributed to 13 laboratories for collaborative analysis. Some 8 replies had been received. A preliminary report, showing encouraging results, was discussed. Further replies were expected. A detailed report would be distributed later. It was agreed that this detailed report should be a basis for contact with the participating laboratories and, possibly, further studies. Collaboration with other international agencies engaged in collaborative studies on the determination of mercury was discussed. Such agencies would be invited to provide samples for being analyzed, in interested laboratories, in order to check the AAS method.

5. Determination of Lead in Food

An AAS-finish was to be developed as an alternative to the spectrophotometric IUPAC method published in 1965. An amended proposal had been elaborated by Dr. OHNO and distributed to Members. Some comments had been received. They were included in a further proposal with some new amendments made by Dr. OHNO with assistance from Dr. GUTHENBERG and Dr. SCHULLER. It was agreed to carry out a collaborative test on the basis of this proposal, taking into consideration certain additional comments made during the discussion. Dr. KOJIMA agreed to handle this matter.

6. Determination of Cadmium in Food

Dr. COLLINGS (Secretary of the Food Section) presented an updated report on methods available for determination of cadmium in food. Some comments were made by Members. Prof. TRUHAUT stressed the need for a short introduction giving the toxicological background. A recent study by AOAC should also be considered. It was agreed that Dr. COLLINGS, in collaboration with Profs. REITH and TRUHAUT, should finalize the report for publication as a Technical Report appendix to the *Information Bulletin*, taking into consideration the above comments. On the basis of this final report a decision would be made with respect to the desirability of a collaborative test according to Dr. SCHULLER's method for determination of both lead and cadmium. Dr. KOJIMA agreed to handle this matter.

7. Determination of Copper in Food

The spectrophotometric IUPAC method published in 1959 was to be provided with an alternative ASS-finish. Dr. OHNO and Dr. SCHULLER had proposed such methods which had been distributed to Members. Some comments had been received. Apparently, both methods were useful. Dr. OHNO had provided an AAS-finish as requested. Dr. SCHULLER, in addition, had also proposed procedures for digestion and separation, aiming at a standardized method for simultaneous determination of various trace metals. He had, however, met certain difficulties in the separation of copper when using the method earlier elaborated for cadmium and lead, and had therefore introduced some modifications. Dr. SCHULLER agreed to study this detail further.

8. Determination of Selenium in Food

A review of methods for the determination of selenium in food had earlier been presented by Dr. J. SANDLER. Certain comments had been received, mainly from Dr. L. E. COLES, and forwarded to Dr. SANDLER for action. Because Dr. SANDLER was no longer a Member of the Commission nor the Food Section, it was agreed to ask Dr. COLES to take over this item, *i.e.*, to amend the report and to advise if a new methodology with an AAS-finish should be proposed.

9. Determination of Fluorine in Food

Prof. TRUHAUT informed the meeting that he had collected extensive references. He intended to present a critical review and a recommendation soon.

10. Determination of Aflatoxin

The aflatoxin M collaborative study was now completed and prepared for publication. Considering the methods used, the Commission felt that, because newer methods were being described, the methods used in the study should have IUPAC provisional status. The collaborative study should be published as a Technical Report.

The publication of SHOTWELL and STUBBLEFIELD [*J. Assoc. Offic. Anal. Chem.* **55**, 781 (1972)] on a collaborative study of the CB method and a screening method for aflatoxin in corn and soy-beans was discussed. Concern was expressed at the large number of false negative results by use of the screening method. In view of the known performance of the CB method, it was agreed to recommend the CB method as an IUPAC method.

Notice was again taken of the rapid development in column detection methodology. Qualitative results at the 5 mg/kg level were obtainable in 5–15 minutes. Because this was potentially a useful method, collaborative studies by the originators of the method were awaited. Dr. CAMPBELL would prepare a report on these methods.

11. IUPAC Participation in International Aflatoxin Check Sample Series

Mr. WALKER reported that IARC was prepared to handle this matter, provided finance was available (\$7,000/annum). Discussions with the respective committee were under way, planning to seek funds from various government bodies, scientific societies, and other sources. A fund solicitation letter would be sent to interested and potential contributors. Copies of the letter would also be sent to each Member of the Food Section with the request to bring it to the attention of his associates. It was noted that a similar operation for cotton seed and cotton seed meal was being carried out in USA and that association with IUPAC was sought. It was agreed that the parties concerned should be put in contact with one another in order to rationalize the programmes.

12. Determination of Mycotoxins other than Aflatoxins

(i) *Ochratoxin A*. NESHEIM's collaborative study on ochratoxin A analysis had now been published in *J. Assoc. Offic. Anal. Chem.* The published collaborative study was considered by the mycotoxin group. It was agreed that this should receive IUPAC recommended status. This was to be regarded as an important decision, because ochratoxin was known to produce diseases in farm animals and was suspected to cause kidney diseases in man.

(ii) *Citrinin*. Because of its association with ochratoxin A, citrinin was regarded as equally important. A collaborative study on citrinin methodology was needed, but it could not be carried out by Commission Members this year.

(iii) Other mycotoxins which should receive attention in the next year, were sterigmatocystin, T-2 toxin, zearolenone, and patulin.

13. Determinations of Compounds in Single Cell Protein Products

(i) *Available Lysine*. The recommendation of the CARPENTER and the ROACH

et al. methods for determination of available lysine was confirmed to the Fermentation Industries Section and PAG. However, on the basis of information made available by BP Proteins Ltd., in the case of 'petroleum yeasts' the ROACH method was to be preferred.

(ii) *Methionine*. It was concluded that the recommendation of the MOORE and STEIN procedure, already adopted by the Fermentation Industries Section and PAG, might be tentatively confirmed. Additional information was to be sought on the results of British collaborative testing.

(iii) *Purines and Purine-containing Compounds (RNA, etc.)*. Two papers were contributed from Dr. JONES' laboratory and another one from BP Proteins Ltd. It was agreed that these papers should be tentatively recommended to the Fermentation Industries Section for screening and reference analyses, respectively. The author would be approached to modify papers for provisional or full consideration. A collaborative test on RNA-DNA-purine analysis on petroleum yeasts should be attempted. Finally, it was agreed that the Fermentation Industries Section should be warned of the possibility of microbial toxin formation.

14. Symposium on Control of Mycotoxins

A selection of the papers from the Symposium held at Kungälv in August 1973 would be published in *Pure and Applied Chemistry* (Volume 35, Number 3, 1973). Dr. KROGH was acting as the Symposium Editor.

15. Purity Requirements for Dispersion Solvents

Dr. COLLINGS (Secretary of the Food Section) had circulated a report on this subject and received certain comments. He now presented a revised report for consideration by the Members. Comments were requested to be sent by the end of September. The report was intended to be published as a Technical Report appendix to the *Information Bulletin*.

16. Round Table Discussion on 'Purity Requirements for Food Additives and their Standardization'

Dr. MARCUSE reminded Members of the imminent discussion (Hamburg, 30 August 1973) on 'Purity Requirements for Food Additives and their Standardization'. Dr. SCHULLER stressed the need of guidelines for setting requirements of food additives. Prof. TRUHAUT agreed and identified three pertinent steps: elaboration of lists of additives, of specification requirements, and of test methods. Dr. CAMPBELL announced an updated edition of the US Food and Drug Administration's Food Additives and Pesticides Manual issued in fulfilment of law requirements. The Manual, which was available on request, contained analytical methods which had been published in advance in the Federal Register.

17. New Methods for Determination of Aflatoxin in Peanuts

At this stage, the IUPAC method for detection of aflatoxin in peanuts appeared to be satisfactory. There was, however, the need to have (a) a high quality reference method which could be carried out in sophisticated laboratories, and (b) a screening method which could be carried out in field laboratories. Attention would be given to these two points.

18. Sampling Plans for Mycotoxin Analysis

This year the paper by WHITAKER should be published by IUPAC and further work in this area were continuing in USA. Prof. KRÖNERT would review sampling and sample preparation for the next meeting.

19. Mycotoxin Formed during Shipment of Foodstuffs

Dr. HESSELTINE had raised the question of mycotoxin formation during transport between countries. A number of people were interested in this problem, which required the type of international participation that IUPAC could provide. Drs. KROGH, CAMPBELL, STEYN, SCHULLER, HESSELTINE, and JONES and Prof. KRÖNERT would collaborate on this project.

20. Mycotoxin Residues in Food of Animal Origin

Consideration was given to mounting a collaborative study on ochratoxin and aflatoxin residues in meat. This would be decided at the next meeting.

21. Other Proposals

Members had been asked for proposals of further projects in the field of interest of the Commission. Interest was expressed in standardization of methods for destruction of organic matter, preferably in collaboration with Profs. K. L. CHENG and A. MIZUIKE of the Commission of Microchemical Techniques and Trace Analysis. Dr. KOJIMA agreed to handle this matter. Concerning single cell protein, it was proposed to discuss with UK Agricultural Research Council a collaborative test for methionine. The results should be made available to IUPAC in order to upgrade the status of the recommended IUPAC procedure. Further, preparations should be made for a collaborative test on RNA-DNA-purine analysis on petroleum yeast, *Rhizopus oryzae*, and for small scale collaborative testing of lead, mercury (and copper?) methods for single cell protein. Contact should be maintained with the Fermentation Industries Section which might require further analytical assistance. Proposals for work on 'positive' aspects of food chemistry comprised an exploratory exercise of the evaluation of chemical indices for quality in flesh food (meat, fish, poultry), and aspects of the chemistry of quality control of spices.

22. Special Projects for Funding from Trusts and Foundations

The following projects were found to be of sufficient interest to be brought to the knowledge of the Section for consideration:

- (i) determination of vegetable protein in meat products,
- (ii) collection of available data on the occurrence of contaminants in foods and diets,
- (iii) further international cooperation aiming to coordinate and standardize methods for purity control of food additives.

23. Date and Place of Next Meeting

The next meeting would be held during July 1974 in Warsaw.

SECTION ON FERMENTATION INDUSTRIES (VI.2)

22-25 August 1973

Present: Dr. A. F. LANGLYKKE (Chairman), Dr. S. KINOSHITA (Vice-Chairman), Dr. J. C. HOOGHEIDE (Secretary), Dr. R. J. ERTOLA, Prof. A. FIECHTER, Prof. I. HORVÁTH, Prof. S. J. PIRT (Titular Members); Mr. W. K. BRONN, Dr. B. M. LAINE, Dr. F. PARISI, Dr. L. STONE, Prof. H. SUOMALAINEN (Associate Members).

A moment of silence was observed to honour the memory of two distinguished former Members and founders of the Section who had passed away during 1973: Dr. C. N. FREY (USA) and Prof. H. LUNDIN (Sweden).

1. Minutes of Previous Meeting

The minutes of the meeting held at Kyoto during 20-24 March 1972 [see *Information Bulletin* No. 44 (December 1972), pages 27-29] were approved without comment.

2. Membership

The Chairman, Dr. LANGLYKKE, had completed two 4-year terms and was no longer eligible for service as a Titular Member. Unanimously Dr. LANGLYKKE was elected an Associate Member of the Section. Prof. A. B. HUMPHREY (USA) was elected a Titular Member for a period of 4 years. Acad. I. MÁLEK, Dr. KINOSHITA, and Dr. ERTOLA, having completed 4-year terms as Titular Members, were unanimously reelected for a second 4-year term. Prof. H. DELLWEG (Federal Republic of Germany) was elected an Associate Member. Dr. KINOSHITA was elected Chairman of the Section with Prof. HUMPHREY as Vice-Chairman. Prof. SUOMALAINEN and Mr. BRONN tendered their resignation as Associate Members.

3. V International Fermentation Symposium

Application papers for IUPAC sponsorship of the V International Fermentation Symposium, to be held in 1976 at Berlin, were received from the Managing and Scientific Directors and the Board of Guardians of Institut für Gärungsgewerbe und Biotechnologie. The Section strongly supported this application and took the required steps to channel these papers to the required authorities for IUPAC approval.

An advisory Programme Committee was established consisting of the following Section Members: PARISI (Chairman), PIRT, HORVÁTH, and FIECHTER, to assist the local Programme Committee in developing the scientific programme. The Local Committee would transmit programme information to the Section Members and would receive comments, criticism, and suggestions from them.

4. VI International Fermentation Symposium (1980)

The Secretary of the Section would request Dr. T. K. GHOSE to contact Dr. K. S. GOPALKRISHNAN (Antibiotic Research Centre, Poona, India) to enquire whether the Association of Microbiologists of India was still willing to organize this Symposium and what facilities were available, prior to considering a request for IUPAC sponsorship of this meeting.

5. Single Cell Protein Standards for Protein of Microbial Origin

A report was received by the Section on 'Pekilo', a fungus product produced on sulfite waste liquor. Because this product had been approved for animal feed use in Finland, it was important that the SCP standards be extended to cover this product. A revised draft of proposed guidelines for testing of SCP destined as major protein source for animal feed was submitted to all Members of both the Fermentation Industries and Food Sections. A joint meeting with the Food Section (see page 226) served to confirm analytical methodology and to delineate areas of uncertainty. On the advice of the Food Section acceptable methods had now been established, though subject to continual review. The Fermentation Industries Section examined the report in full detail with particular attention to the quantitative specifications. The revised standards would be prepared for early publication by IUPAC. Drs. F. TANAKA and M. KANAZAWA (Kanegafuchi Chemical Industry Co. Ltd., Osaka) and Dr. K. W. G. SHILLAM (Huntingdon Research Centre, UK) attended all SCP sessions as invited Observers. These persons contributed materially to the establishment of the revised standards and to the definition of analytical methods.

6. Cooperation with International Association of Cereal Chemists

Ing. H. WUTZEL and Dr. H. FUCHS (ICC) attended part of the Fermentation Industries Section meetings to discuss collaboration between the Section and ICC. Of the 32 Working Groups of ICC, Group 30 was concerned with yeast quality evaluation and covered the main area of common interest. To promote cooperation it was agreed that there should be exchange of minutes of meetings as well as exchange of Observers at scheduled meetings. The programme of establishing reliable methods for yeast quality control would be revitalized, with Dr. PARISI acting as the liaison officer.

7. Education in Bioengineering

A report on the project 'Education in Biochemical Engineering' was submitted by Profs. FIECHTER and PIRT and discussed extensively. It gave the result of the survey held by the Working Group among leading universities with bio-engineering facilities. The report made recommendations based on the opinions of the majority of the participants of the survey. The report was approved, with minor adjustments, for publication after it had been reviewed by the Committee on Teaching of Chemistry.

8. Directory of Research Laboratories in the Field of Fermentation

Due to the fact that no suitable publisher could be found who was willing to take the financial responsibility of publishing such a directory, this project was temporarily eliminated from future action by the Section.

9. Combined Meeting with Water Quality Section

It was decided that the two Sections in close cooperation would organize a two-day symposium where both theoretical and practical aspects of waste water purification would be considered, in particular its microbiological aspects.

It was agreed that it would be advisable to organize such a symposium in conjunction with the meeting of the International Association of Water Pollution Research scheduled for 9–14 September 1974 in Paris. A Programme Committee was appointed with representatives of both Sections (Prof. PEARSON, Dr. CHIPPERFIELD, and Dr. GRAU from the Water Quality Section, and Prof. PIRT and Dr. KINOSHITA from the Fermentation Industries Section). It was proposed that major financing of the Symposium would be achieved by an additional registration fee. The Programme Committee, after its meeting in Munich, recommended that there be 12 invited speakers. The necessary steps would be taken to obtain IUPAC sponsorship of this Symposium.

10. Symbols and Terms for Quantities and Units Used in Fermentation Technology

The report on this subject compiled by Mr. BRONN and submitted to the Section at an earlier meeting was discussed extensively. It gave a survey of the literature on the symbols and terms used in fermentation technology, showing clearly that there frequently existed a highly undesirable confusion in the interpretation of terms and indiscriminate use of symbols for such terms. The Section decided that an abbreviated form of the report would be prepared, as well as a questionnaire with questions as to which terms should be standardized; which definitions and dimensions, if appropriate, should be given to these terms; and whether the proposed symbol was acceptable (if not what substitute symbol was then recommended). The questionnaire would be sent internationally to experts using such terms and symbols. Based on the replies received, guidelines would be prepared for publication and distribution.

11. Name of Section

Because the Section did not represent an 'industry' but a specific technology, it was felt that the name should be changed to 'Fermentation Section'. Steps to accomplish this change in name would be taken in Munich.

12. Date and Place of Next Meeting

The next meeting was planned tentatively for September 1974 at Oxford.

SECTION ON OILS AND FATS (VI.3)

22-25 August 1973

Present: Dr. E. HEINERTH (Chairman), Drs. H. J. VOS (Secretary), Dr. N. D. EMBREE, Dr. G. LOEW, Dr. K. A. WILLIAMS (Titular Members); Dr. J. CORNELIUS, Prof. E. L. DELVAUX, Prof. M. NAUDET, Prof. A. RUTKOWSKI (Associate Members); Dr. H. BRÜSCHWEILER, Dr. J. GRACIAN-TOUS, Drs. P. W. HENDRIKSE, Dr. Ö. LEVIN, Dr. P. R. E. LEWKOWITSCH, Mr. S. B. LINTZ CHRISTENSEN, Mr. A. T. MØLLER, Prof. R. MONACELLI, Prof. H. NIEWIADOMSKI, Prof. C. PAQUOT, Dr. J. POKORNÝ, Dr. M. TEUPEL, Drs. J. C. VAN DER WEEL, Dr. H. H. R. H. WENDT (National Representatives); Prof. T. ASAHARA, Dr. H. CHAVERON, Dr. A. DIEFFENBACHER, Drs. H. GALENKAMP and Dr. E. KURUCZ (Observers).

1. Minutes of Previous Meeting

A report on the meeting held in Chester (6-7 September 1972) had been published in *Information Bulletin* No. 45 (May 1973, pages 30-32).

2. Membership

(i) The following nominations were approved (AM=Associate Member; NR=National Representative):

Commission on Oils and Fats (VI.3.1)

Dr. C. CAROLA—Italy (AM)

Dr. A. DIEFFENBACHER—Switzerland (NR)

Prof. K. A. KUMMEROW—USA (NR)

Drs. P. W. HENDRIKSE—Netherlands (NR)

Commission on Soaps and Oleochemicals (VI.3.2)

Dr. J. F. CONNOLLY—Ireland (AM)

Dr. R. T. O'CONNOR—USA (NR)

Mr. D. C. REYNOLDS—Ireland (NR)

(ii) With the exception of Dr. N. D. EMBREE, all Titular Members were replaced. The assembly unanimously agreed with the nomination of the resigning Secretary, Drs. J. H. VOS, as the new Chairman, of Prof. C. PAQUOT as the new Secretary, and of Dr. H. BRÜSCHWEILER, Prof. E. L. DELVAUX, Dr. J. GRACIAN-TOUS, Mr. A. T. MØLLER, and Drs. J. C. VAN DER WEEL as the other new Titular Members.

3. Chairman's Report

Dr. HEINERTH referred to the reorganization of the Applied Chemistry Division, as a result of which more attention would have to be paid in future to food chemistry and environmental problems. In this connection, it would be essential to draw up longterm programmes. Close relations were being maintained with national and international organizations working in the same field as the Oils and Fats Section. In order to avoid overlapping of activities, joint meetings were to be held during the Conference with the Food and Pesticides Sections.

Six more standard methods, approved by the Section at previous meetings, were in course of publication by Butterworths in loose-leaf form, both in

French and English. They would appear before the end of 1973 or early in 1974 as the third supplement to *Standard Methods for Analysis of Oils, Fats, and Soaps* (5th Edition, 1964):

- II.C.6 Determination of the phosphoric acid test (PAT) value of raw linseed oil
- II.C.7 Determination of mono-, di-, and triglycerides by column chromatography
- III.A.3 Determination of water in glycerol (Karl Fischer method)
- III.A.4 Determination of ash in crude glycerol
- III.A.5 Determination of alkalinity or acidity of crude glycerol
- III.A.6 Calculation of MONG in crude glycerol

Finally, the Chairman again emphasized the importance of reviewing the methods published in 1964 and in the first supplement (1966) in order to bring them into line with modern developments and conceptions.

4. Work Programme 1972-1973

The participants discussed the results of the following investigations:

- (i) *Determination of Melting Behaviour of Fats*. It was decided to continue study of the method in question after modification of its text by Prof. PAQUOT.
- (ii) *Determination of Total Quantity of Oxidized Acids*. The results were not satisfactory. Therefore, it was agreed that the collaborative tests be continued and that the text of the method be modified by Prof. NAUDET.
- (iii) *Determination of Composition of Fatty Acids in β -Position in Triglycerides of Oils and Fats by Pancreatic Lipase*. The method was adopted as a standard method. Dr. GRACIAN-TOUS and Drs. HENDRIKSE would prepare the final text in accordance with the various comments made.
- (iv) *Detection and Identification of Antioxidants in Oils and Fats*. Three methods were studied. The TLC method, proposed by Ing J. B. ROOS, was adopted as a standard method. The procedure for the quantitative determination of BHT and BHT based on the official one of the Nordisk Metodik-Komité for Levnedsmidler, was adopted as a tentative standard method; as soon as a satisfactory GLC method became available, the work would be continued.
- (v) *Determination of Lower Fatty Acids by Gas Liquid Chromatography*. Three methods were investigated. On the basis of the results obtained, it was decided to continue the collaborative tests on the method of CHRISTOPHERSON and GLASS after modification of the text by Drs. HENDRIKSE.
- (vi) *Determination of Tocopherols in Oils and Fats*. The results were not satisfactory. It was agreed to reinvestigate the two methods studied this year after modification of the respective texts by Dr. GRACIAN-TOUS (Spanish method) and Drs. HENDRIKSE (Dutch method).

A report was given by Prof. DELVAUX (Chairman of the Pesticides Subcommittee) on the results obtained by the Members of his Subcommittee. It was decided that the collaborative tests on the WESTÖÖ method should be continued.

5. Work Programme 1973-1974

In addition to the programmes continuing from the previous year, it was agreed to study also the determination of *trans* fatty acids by differential IR spectrometry according to a method proposed by the Netherlands delegation.

The texts of the standard methods for preparation of the methyl esters of fatty acids and for their determination by gas liquid chromatography, drafted by prof. PAQUOT on the basis of the decisions taken at the first meeting of experts of ISO, IUPAC, IDF, and OICC (Paris, 30 May 1973), were discussed. Prof. PAQUOT promised to modify the texts in accordance with the comments made; in his opinion, it would be essential to have the revised texts circulated before the next meeting of the experts (Autumn 1973).

6. Other Activities

The participants discussed the problems, which could be studied in future, for instance:

- (i) determination of *cis-cis* linoleic acid (one of the essential fatty acids) in oils and fats
- (ii) determination of residual solvent in oils obtained by solvent extraction
- (iii) determination of the position of double bonds in hydrogenated fats
- (iv) plastics in fats, especially fats from waste material (technical tallows and greases)
- (v) total fat content and water content of margarine
- (vi) percentage of solid fat in fats by NMR
- (vii) oil content of oilseeds and oilcakes by modern rapid methods
- (viii) qualitative and quantitative determination of emulsifiers in oils and fats
- (ix) sulfur compounds in oils, like rapeseed oil, mustard oil, fish oil
- (x) trace elements in oils and fats (Se, Hg, Pb, Cd, Fe, Cu, Ni, Cr, *etc.*)
- (xi) dimeric, polymeric, and cyclic acids, formed during refining and use (deep fat frying) of oils and fats.

With regard to the future activities of Commission VI.3.2, it was proposed to carry out investigations in the following fields:

- (i) fatty acid derivatives and related products, like soaps, fatty alcohols and derivatives, fatty amides and fatty amines plus derivatives
- (ii) glycerol, derivatives from glycerol and related products, like polyglycerol, polyglycerolesters (emulsifiers), monoglycerides and derivatives
- (iii) lecithine and derivatives

as far as these items were not covered already by the activities of other international organizations.

A report was given by Dr. EMBREE on the 'International Aspects of the Activities of the American Oil Chemists' Society Instrumental Techniques Committee', which report was prepared by Dr. R. T. O'CONNOR. It contained details of the collaborative tests regarding the determination of the solid fat content of fats by NMR.

Joint meetings were held in Munich with the Pesticides Section (on 22 August—see page 246) and with the Food Section (on 24 August—see page 228) in order to exchange views on problems of mutual interest and to avoid overlapping of work. The discussions were most valuable; it was agreed to continue these collaborations and to keep each other informed of all further developments by circulating the annual reports.

7. Date and Place of Next Meeting

The Polish delegation invited the Oils and Fats Section to meet in Warsaw at the end of August 1974.

Joint Meeting of Section on Oils and Fats (VI.3) and Section on Pesticides (VI.5)

22 August 1973

Present: 15 Members of Section on Oils and Fats, 8 Members of Section on Pesticides, 2 Observers.

The meeting was held under the Chairmanship of Dr. D. C. ABBOTT (Chairman of the Pesticides Section). Prof. E. L. DELVAUX introduced the discussion, explaining why the Oils and Fats Section had started collaborative tests on organochlorine pesticides. The reason was that oil chemists were often asked to determine whether a sample of oil or fatty food contained pesticides. It was also very important for the oil chemist to follow the refining process of edible oils and although natural materials nearly always contained pesticides, refined oils and fats, after having undergone a deodoration process, were nearly free from residues of organochlorine and organophosphorus pesticides.

Since 1969 collaborative tests had been run by different laboratories: some had given outstanding results, other laboratories very bad ones. The MILLS method was proposed but many difficulties arose from the variability of the FLORISIL; they then proposed the NOREN and WESTÖÖ method, which used an easily standardized BROCKMANN aluminium oxide. Dr. ABBOTT who was interested personally in residue analysis, used, amongst others, the WOOD method and the Oils and Fats Section would be provided with details of this procedure. Also, Dr. ABBOTT would give the references for three methods by COLLINS.

Pesticide residue analysis needed much skill and it was necessary to be very careful because there were no universally applicable methods. The aim of the Oils and Fats Section was limited to analytical work and did not interfere with the Pesticides Section. Dr. ABBOTT agreed that his staff should participate in the future collaborative tests of the Oils and Fats Section. The Pesticide Section was interested in all residue analysis and in all kinds of material (food, soil, water, *etc.*), whereas the Oils and Fats Section was only concerned with pesticides contained in fatty matter. The Oils and Fats Section was not interested in the level of terminal residues. However, it was thought desirable that natural fatty food should be within the limits in the WHO Technical Report No. 525—'Pesticides Residues in Food' (report of 1972 joint FAO-WHO meeting); this information was given by Dr. ABBOTT.

On behalf of the organizers, Prof. P. E. KOIVISTOINEN invited the Oils and Fats Section to the III International Congress of Pesticide Chemistry, which would be held in Helsinki in July 1974.

SECTION ON AIR QUALITY (VI.4)

22-26 August 1973

Present: Mr. J. L. MONKMAN (Chairman), Prof. R. G. SMITH (Secretary), Dr. W. G. FREDERICK, Dr. J. C. CAGE, Dr. W. PIETRULLA, Prof. P. W. WEST (Titular Members); Dr. M. FUGAS, Mr. S. G. LUXON, Dr. W. PILZ, Prof. R. TRUHAUT (Associate Members).

1. A report of the meeting held in Washington, DC, during 15-18 July 1971 had been published in *Comptes Rendus XXVI Conference* (pages 223-224).

2. At the commencement of the Section meetings, it became evident that some confusion existed concerning the work previously completed by the Section and the failure to have already published some previously submitted analytical methods. The Chairman succeeded in discussing the matter with the President of the Applied Chemistry Division and the Assistant Secretary of the Union, resulting in a visit from Dr. R. W. CAIRNS, at which time it developed that some misunderstanding had apparently occurred which was responsible for the delay. Dr. CAIRNS made it very clear that the misunderstanding had been cleared up and that henceforth prompt action would be assured by him so that methods could be hastened to publication to the greatest extent possible. Also, Dr. CAIRNS stated very clearly his view of the Section's areas of interest, and was in perfect agreement with the Section on the division of responsibilities between the Air Quality Section and the Clinical Chemical Section. In brief, whenever the evaluation of environmental exposure required measurement of biological samples, the Air Quality Section was clearly entitled to recommend suitable procedures and whenever clinical diagnosis of illness was involved, it was the responsibility of the Clinical Chemistry Section to do so. Areas of overlap were expected to be resolved by intelligent agreements reached by discussions between the two Sections, and such agreements had already been made by Prof. TRUHAUT acting in this manner. Dr. CAIRNS also expressed the hope that the Air Quality Section's activities would give proper emphasis to air pollution matters (outside air) as well as to industrial health problems (workplace air).

3. Prior to the meeting, Mr. MONKMAN had distributed a list of fifteen subjects of possible interest to SCOPE and/or IUPAC, and these were next discussed. One of the principal results of the discussion was to make a recommendation for an international symposium to be organized on the subject 'Acidic Aerosols: their Measurement and Effects'. Such a symposium would concern itself primarily with the complex aerosol containing sulfuric acid and other acidic substances, which was believed by many to be primarily responsible for mortality and morbidity experienced during such air pollution disasters as occurred at Mense Valley, Druorah, and London in past years, and was, therefore, of obvious international significance. The Air Quality Section would like to seek the assistance of SCOPE to work with IUPAC in organizing such a symposium at the earliest possible date. Several Members, in particular Prof. WEST and Mr. MONKMAN, were doing work on the complex problems of sampling and analyzing acidic aerosols, and believed that the symposium could be a major contribution to aiding in a better understanding of the role of such aerosols in relation to human health effects and urban air pollution.

4. Mr. LUXON also proposed that an international symposium on analytical methods for asbestos would be extremely timely, and after considerable

discussion the Section agreed that a symposium with the tentative title 'An Examination of Analytical Methods for Asbestiform Minerals and Related Inorganic Fibrous Materials' should be recommended. Support from SCOPE could be sought, but in addition, the very great importance of the subject to the asbestos-using and -producing industries was felt to be such that these industries could be expected to offer financial support for such a symposium.

5. Mr. LUXON suggested that there should be greater liaison between IUPAC and ECE and offered to effect such liaison informally at a meeting of ECE in September 1973. At such times, the expertise of the Air Quality Section should be offered, with appropriate actions, if accepted by ECE.

6. A general discussion of the Section's manual of *Analytical Methods for Use in Occupational Hygiene* resulted in agreement to revamp completely the preamble, with Prof. WEST concentrating on matters relating to outdoor air and Mr. LUXON doing likewise with workroom air. Their drafts would be reviewed first by Prof. TRUHAUT and Mr. MONKMAN, then by the entire Membership.

7. Reviews of specific analytical procedures for substances in the air or in biological samples were made as follows:

(i) Dr. FREDERICK reviewed existing methods for carbon monoxide in air, and agreed to prepare suitable versions of three different methods: (a) indicator tube procedures, (b) nondispersive infrared (NDIR), and (c) catalytic reduction to methane and GC determination.

(ii) Dr. PIETRULLA stated that the methyl bromide method was in final form, and would be checked editorially by Mr. MONKMAN and Prof. SMITH. The phosphine method was in progress and might be completed by January 1974. The same was true of nitroglycol and EGDN method, and Dr. PIETRULLA would prepare a shortened version for further review. Also, he would continue work on methods for primary aliphatic amines.

(iii) Dr. GAGE had completed work on indicator tubes, hydrogen chloride, and lead dust in air, and these had been passed to the Secretariat. Dr. GAGE and/or Prof. SMITH would submit a draft for the electrometric method for cholinesterase.

(iv) Mr. LUXON had completed optical X-ray diffraction methods for asbestos and after checking by other Members, these were considered ready for publication. The ozone method was in the same state and would be checked by several Members. An additional ozone method utilizing charcoal to destroy ozone was submitted by Dr. PIETRULLA and another based on the ozonization of eugenol was recommended by Prof. WEST.

(v) Mr. MONKMAN had completed his review of several methods prepared by Dr. PILZ, e.g., HDF, TDI, and vanadium in air. He considered that there were presently no satisfactory methods for sulfuric acid mist (Prof. WEST agreed), and none should be recommended at this time. Work in progress by Mr. MONKMAN included iron, antimony, and mercaptans. Benzo(a)pyrene had been completed and was now in the hands of the Secretariat.

(vi) Prof. WEST had completed atomic absorption spectroscopic methods for cadmium, lead, and vanadium, and these were now in the hands of the Secretariat. Also, he had submitted: sulfur dioxide method of WEST and GAEKE; sulfur dioxide-coulometric; fluoride method, lead, nickel, cadmium, and sulfuric acid by ring oven technique; and spectrophotometric methods for nitrates in air using chromotropic acid and brucine. Prof. WEST would submit

a newly perfected nitrogen dioxide method based on sampling in triethanolamine or alkaline solutions of phenols.

(vii) Prof. SMITH reported on sampling and analysis of phenolic compounds in air and in urine. He would prepare one method based on the use of 4-aminoantipyrine and two based on GC analysis.

(viii) Dr. PILZ had prepared drafts of 18 methods as follows: hydrazine, vanadium, MDI and naphthalene diisocyanate in air; phenol, vanadium, and trichloroacetic acid in urine; vanadium in blood; thiophenol, nitrogen dioxide, nicotine, pyridine, caprolactam, and mineral oil in air; carbon monoxide, cholinesterase, and methaemoglobin in blood; as well as hydrogen peroxide in air. Extensive discussion of all of the above methods resulted in many specific assignments.

8. It was unanimously agreed that a meeting of the Air Quality Section should be held in mid-1974 in order to ensure publication as rapidly as possible of the large number of methods under consideration, and to facilitate planning for either of the two recommended symposia if approved. Dr. FUGAS kindly offered to host such a meeting in Yugoslavia and the Section enthusiastically accepted this offer, with planning to proceed if approval for such a meeting was granted.

SECTION ON PESTICIDES (VI.5)

22, 23, and 27 August 1973

Present: Dr. D. C. ABBOTT (Chairman), Dr. P. SLADE (Secretary), Dr. K. FUKUNAGA, Dr. K. R. HILL, Dr. H. HURTIG, Prof. P. E. KOIVISTOINEN, Dr. CH. RESNICK (Titular Members); Dr. H. FREHSE (by invitation).

1. Minutes of Previous Meeting

The minutes of the meeting held in Washington, DC, during 15–20 July 1971 [see *Information Bulletin* Nos. 42/43 (July 1972), pages 8–10] were adopted.

2. Matters Arising from Minutes

(i) Liaison with AOAC had been discussed at the 1971 meeting with agreement to return to the discussion at the next meeting. Members felt generally that closer liaison with AOAC was desirable, and that the Association should be invited to send an Observer to the Pesticides Section-Commission meetings. In addition, it would be useful for an IUPAC Observer to be invited to attend appropriate AOAC meetings.

(ii) There was discussion of the 'public relations' questions raised in 1971. Dr. FREHSE felt that the scientific aspects of the Section's work were not sufficiently widely known, even to pesticide specialists. He agreed to write an article for *Residue Reviews*, outlining IUPAC's activities in pesticide chemistry. The question of wider public relations was discussed briefly, and it was acknowledged that this was linked to IUPAC's general concern about the relevance of its work and communication to the public.

3. Membership

(i) In introducing this topic, Dr. ABBOTT referred to the previous day's Applied Chemistry Division Committee meeting (see page 215), at which it was made clear that the financial constraints on IUPAC would continue. Any increase in the Section Membership was therefore unlikely, and Sections would need to convince the Division President of the priorities to be assigned to various parts of their programme and to Membership nominations.

(ii) The terms of Membership of several Members expired in 1973. The Section discussed and agreed the desirable future Membership of the Section and its two Commissions, and its recommendations would be discussed with each Commission before being handed to the Applied Chemistry Division President for approval by himself and the Bureau. Dr. K. R. HILL and Dr. P. C. KEARNEY would be nominated as Chairman and Secretary, respectively, of the Terminal Residues Commission (VI.5.1) and Dr. H. FREHSE as Chairman of the Residue Analysis Commission (VI.5.2) and Vice-Chairman of the Section. Dr. P. SLADE would remain Secretary of Commission VI.5.2. Dr. KEARNEY would also be nominated as a Titular Member of the Section, and other nominations for Titular Membership would be Dr. J. MIYAMOTO and Dr. G. WIDMARK. Dr. V. BÁTORA, Dr. H. HURTIG, and Dr. CH. RESNICK were nominated as Associate Members.

4. Publications

It was generally agreed that *Residue Reviews* would be a suitable additional

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medium for publication of the Section's detailed reports, because this would ensure wider dissemination amongst pesticide workers than was achieved by publication in IUPAC publications alone. Dr. HURTIG agreed to approach the editor of *Residue Reviews*. A summary report would also be submitted to *J. Assoc. Offic. Anal. Chem.* as in the past.

5. Relations with International Organizations

(i) *FAO*. It had now been agreed that IUPAC should have official consultative status with FAO; Dr. E. E. TURTLE was the liaison officer. There was discussion of the environmental work with pesticides which might be initiated within FAO, and it was hoped that IUPAC could assist in this work.

(ii) *WHO*. A reprint of an article by Dr. F. C. LU on 'Toxicological Evaluation of Food Additives and Pesticide Residues' [*WHO Chronicle* 27, 43 (1973)] had been received.

(iii) *Codex Committee on Pesticide Residues*. It was noted that Dr. A. KRUYSSSE had retired from the Codex Committee.

(iv) *CEE*. It was noted that discussions were continuing within CEE as to the best way in which to present recommendations regarding the analytical methods to be used in connection with the enforcement of proposed legislation concerning residues of pesticides in various commodities.

(v) *COMECON*. Prof. KOIVISTOINEN noted that this organization was interested in forming links with IUPAC and he agreed to continue the liaison links he had started.

(vi) *OECD*. It was noted that this organization had no specific interests in pesticides to raise at present.

(vii) *FAO-IAEA*. There was to be a meeting in Vienna in November 1973 on Isotopic Tracer Aided Studies on the Origin and Fate of Foreign Chemical Residues in the Agricultural Environment.

(viii) *AOAC*. This was discussed under Item 2(i). Dr. ABBOTT agreed to write to Dr. W. HORWITZ.

(ix) *WMO*. This body had some interests in the atmospheric fate of pesticides, and it was agreed that it should be invited to send an Observer to the next Pesticides Section meeting.

(x) *EPPO*. It was noted that this organization was interested in residue analytical methods. An Observer would be invited to the next Pesticides Section meeting.

(xi) *ICSU-SCOPE*. Relations with this organization were discussed briefly.

(xii) *Miscellaneous*. It was noted that many bodies were now concerned with the interaction of pesticides with man, his food, and the environment, and the hope was expressed that there would not be too much duplication of effort.

6. International Pesticide Chemistry Congresses

(i) *Helsinki 1974*. Prof. KOIVISTOINEN reported that preparations for the III Congress were well in hand. Invitations had been sent out on a very wide geographical basis. Dr. HURTIG suggested that the proposed sessions on regulatory matters might conflict with similar sessions at the 1975 Plant Protection Congress, but Prof. KOIVISTOINEN had established that there should be no problem arising. It was agreed that one successful feature of the II Congress in 1971 (Tel Aviv) which should be repeated, was the 'workshop'

sessions. In addition, it was considered desirable to close the meeting with a number of summaries of the various topics covered, to be given by authorities in the fields in question.

(ii) *Future Congresses*. It was agreed that it was a desirable aim to attempt to link future IUPAC Pesticide Chemistry Congresses with the Plant Protection Congresses, and correspondence on this subject was noted. However, complete integration was not desirable, because this would lead to too large a meeting. It would certainly be worth holding some plenary sessions with biological content at future meetings in the IUPAC Congress series. Possible locations for the next IUPAC Pesticide Chemistry Congress were discussed and a short list was drawn up.

7. Future Section Policy

(i) *Environmental Matters*. Proposals to widen the Applied Chemistry Division's involvement in topics related to the environment were noted and discussed. The Section's two Commissions already considered some environmental problems of pesticides at their meetings. In any case, the problems of pesticide residues in food (the Commissions' main concern at present) were not fundamentally different from related environmental questions, so that no real change of direction was required. For clarity in presenting information, it would be worth separating clearly the Commissions' reports in the future into two sections, one devoted to residues in food, with particular reference to the WHO-FAO requirements, the other concerned with environmental aspects. There was a strong feeling that there would be duplication of the Applied Chemistry Division's efforts if wholly new environmental Commissions were formed at this stage, and proposals were submitted to the Division to avoid this possibility.

(ii) *Other Policy Matters*. The relationship of the Commissions' work to WHO-FAO requirements was discussed. These requirements resulted in a need for specific information on particular pesticides, but there was a need to clarify the Section's objectives in relation to other pesticides. It was agreed that the Commissions should also act as a forum for a discussion of problems in the areas of interest to individual Members, who should bring these to the attention of the Membership. The Commissions should continue to act as consultants to other IUPAC Sections on pesticide residue problems. The possibility of the Section working on problems of nomenclature and definitions was discussed, and it was agreed that this should be done if requested or if the need was apparent to Members. It was agreed that it was essential for the Commissions to meet every year if they were to maintain continuity of their work.

8. Date and Place of Next Meeting

This would be at Jealott's Hill Research Station (Bracknell, UK) by kind permission of ICI Plant Protection Ltd., during 1-4 October 1974. Two days would be devoted to Section and joint Commission meetings with one day each (for technical discussions only) for meetings of the Terminal Residue and Residue Analysis Commissions. Dr. FREHSE mentioned that Bayer AG would be happy to provide facilities for a future meeting of the Section.

COMMISSION ON TERMINAL PESTICIDE RESIDUES (VI.5.1)

23-24 August 1973

Present: Dr. H. HURTIG (Chairman), Dr. K. R. HILL (Secretary), Dr. D. C. ABBOTT, Dr. R. L. BARON, Dr. K. FUKUNAGA, Dr. H. GEISSBÜHLER, Prof. F. KORTE (Titular Members); Dr. N. DRESCHER, Dr. P. E. PORTER (Associate Members); Dr. V. BÁTORA, Dr. W. B. COCHRANE, Mr. K. E. ELGAR, Dr. H. FREHSE, Dr. S. GORBACH, Dr. P. GREVE, Mr. S. G. HEUSER, Prof. P. E. KOIVISTOINEN, Dr. G. E. MAYR, Dr. P. B. POLEN, Dr. CH. RESNICK, Dr. P. SLADE, Dr. E. E. TURTLE, Dr. G. VETTORAZZI, Dr. S. L. VITOROVIČ (Observers).

1. Minutes of Previous Meeting

The minutes of the Sixth Meeting of the Commission, held in Washington, DC, on 16-19 July 1971, had been published, together with Appendices, in *Comptes Rendus XXVI Conference* (see pages 225-246). Dr. GEISSBÜHLER requested that the sentence under Item 4 beginning 'Chlorobenzilate would be deleted' be corrected to read 'Chloropropylate would be deleted'; this was agreed and the minutes were accepted as corrected.

2. Matters Arising from Minutes

The Chairman referred to the following matters:

- (i) Arrangements had been made to publish a summary of the proceedings of the 1971 Meeting in *J. Assoc. Offic. Anal. Chem.*
- (ii) Attention was drawn to documents TR-68 and TR-69 previously circulated, which listed compounds considered by the 1968, 1969, 1970, 1971, and 1972 Joint Meetings of FAO-WHO Experts on Pesticide Residues (JMPR) and for which further information on terminal residues was required or desired.

3. Membership

The following future Membership of the Commission was agreed:

Dr. K. R. HILL (USA) (Chairman), Dr. P. C. KEARNEY (USA) (Secretary), Dr. R. L. BARON (USA), Dr. D. G. CROSBY (USA), Dr. H. GEISSBÜHLER (Switzerland), Prof. F. KORTE (Federal Republic of Germany), Dr. J. MIYAMOTO (Japan), Dr. P. SLADE (UK) (Titular Members); Dr. H. M. DEKHUIZEN (Netherlands), Dr. N. DRESCHER (Federal Republic of Germany), Prof. R. ENGST (DDR), Dr. R. GREENHALGH (Canada), Dr. H. HURTIG (Canada), Dr. G. E. MAYR (Federal Republic of Germany), Dr. P. E. PORTER (USA) (Associate Members).

4. International Liaison

- (i) Dr. TURTLE (FAO) reported that the Monographs of the 1971 JMPR and the Report of the 1972 JMPR had been printed and were now available, although they had not been distributed in time for the present meeting. The Monographs of the 1972 JMPR were now at the printer and should be available soon. Some discussion was held on the difficulty of obtaining these publications. The Secretary suggested that the IUPAC Secretariat be asked to acquire these publications from the appropriate Agencies and distribute them to Members of the IUPAC Pesticides Commissions. Dr. TURTLE agreed to

furnish information to the Commission on the activities of future FAO-WHO Joint Meetings on Pesticide Residues in the event that no IUPAC Members were amongst the experts thereby assembled.

(ii) Dr. VETTORAZZI (WHO) commented on the lack of an arrangement to acquire toxicological data required by the FAO-WHO Joint Meetings on Pesticide Residues similar to the services provided by IUPAC for questions concerning residue analysis and terminal residues. Also, he reported on the present status of the WHO Computer Project for comparing theoretical and actual intakes of pesticide residues with allowable daily intakes (ADIs). Dr. GEISSBÜHLER raised the question of the feasibility of metabolic studies in man as requested occasionally by the FAO-WHO JMPR. It was agreed that this subject was not within the frame of reference of the Commission. The Commission agreed that statements of further work required or desired, appearing in Reports and Monographs of the FAO-WHO JMPR, needed to be clearer in intent.

(iii) Dr. GREVE (CCPR) briefly described the activities of the Codex Committee on Pesticide Residues.

(iv) No representative of CEE or FAO-IAEA was present. It was noted that Prof. KORTE had attended a Meeting of FAO-IAEA in 1972 as the IUPAC representative.

5. Organochlorine Compounds

Dr. HILL presented a report to the Commission on the terminal residues of lindane (Appendix I). Five previously unreported metabolites from the urine of rats fed lindane had been identified as 3,4-dichlorophenol, 2,4,6-trichlorophenol, 2,3,4,5-tetrachlorophenol, 2,3,4,6-tetrachlorophenol, and 2,3,4,5,6-pentachloro-2-cyclohexen-1-ol. These findings appeared to require revision in the current theory regarding the metabolism of lindane in animals. A review of the use and place of lindane in the protection of stored products had appeared. An international symposium on lindane was held in Vienna on 9 June 1972, and the proceedings had been summarized.

Prof. KORTE reported on experiments on lindane metabolism and natural conditions (Appendix II). In hydroponic culture using ^{14}C -lindane, a new substance, identified as dehydrolindane, was found in small amounts (less than 1% of the remaining residue) in the mixture of substances less polar than lindane. Dr. TURTLE called the attention of the Commission to the recent publication of a book entitled *Lindane*, which summarized all the chemistry of lindane known to the date of preparation. The Commission agreed that lindane would appear on future agendas only if new requirements arose from the 1973 meetings of the FAO-WHO JMPR or if new data of significance were published.

Dr. HILL presented a report on current information on the terminal residues of hexachlorobenzene (Appendix III). There continued to be a lack of any experimental evidence to indicate that hexachlorobenzene (HCB) was metabolized by plants, animals, or soil microbes, or that it was degraded into any other products in the environment. Also, Dr. HILL reported that experiments were in progress in USA to determine the rate of disappearance of hexachlorobenzene from soils and the degradation, if any, by soil microorganisms. Dr. BÁTORA called attention to the 1973 meeting of CIPAC, which reported that all samples of quintozone (PCNB) examined had contained about 4-5% HCB as an impurity. Dr. GREVE reported on unpublished works which had

revealed that pentachlorobenzene had been found in all feedstuffs treated with hexachlorobenzene, arising as an impurity in the formulation.

The Commission received a report by Dr. PORTER and Prof. KORTE, summarizing the current state of knowledge on the nature of the terminal residues of cyclodiene insecticides (Appendix IV). Attention was directed to the finding of oxychlordane, 1,2-dichlorochlordane, and photo-*cis*-chlordane in alfalfa grown in soils treated with high purity chlordane. This was the first report of the formation of oxychlordane in plants, but extensive experimentation had indicated that the phenomenon appeared to be confined to alfalfa and then only at very low levels (0.015 ppm of oxychlordane). A further new result was the finding of the surprising transformation of aldrin to 1,2,3,4,9,9-hexachloro-1,4,4a,5,6,7,8,8a-octahydro-1,4-methanonaphthalene by the green alga *Chlorella pyrenoidosa*. Summary data was also presented on dieldrin, heptachlor, endrin, and endosulfan.

There was no report this year on terminal residues of toxophene, dicofol, or BHC. However, Dr. BÁTORA informed the Commission that a report on toxophene would be presented in Poland in September 1973.

Dr. GEISSBÜHLER presented a report on chlorobenzilate (Appendix V) and called attention to the carbinole acaricides published in 1971 [*Residue Rev.* 39, 1-88 (1971)].

The report provided specific answers to requirements posed by the FAO-WHO JMPR at its 1968 and 1972 meetings.

6. Organophosphorus Compounds

The Commission received a report, read by the Secretary, from Dr. E. Y. SPENCER on residues of methyl parathion, azinphosmethyl, and parathion (Appendix VI). Dr. FUKUNAGA presented a report on the nature of terminal residues of diazinon, azinphosmethyl, Cyanox, Phoxim, and Mocap (Appendix VII), and fenitrothion (Appendix VIII). The Commission noted the possibility of different chemistry for diazinon due to different manufacturers. The stability and persistence of fenitrothion was also noted. Dr. HILL presented a prepublication paper to the Commission on the behaviour of residues of azinphosmethyl, ehtion, phosalone, and naled in grape tissues [W. WINTERLIN and C. MOURER, *Pestic. Monitoring J.* in press]. The significant stability of residues of azinphosmethyl and phosalone on bark and cane was noted. Dr. BÁTORA presented a prepublication paper entitled 'Hydrolysis Rate and *in vitro* Anticholinesterase Activity of Fenitrothion and *S*-Methyl Fenitrothion' [J. KOVAČIČOVÁ, V. BÁTORA and Š. TRUCHLIK, *Pestic. Sci.* 4 (1973), in press]. *S*-Methyl fenitrothion, an impurity in the technical material, was 2-3 times more active as a cholinesterase inhibitor than fenitrothion. The potential of fenitrothion for replacing DDT in certain special cases was noted by the Commission.

Dr. GEISSBÜHLER presented reports to the Commission on terminal residues of monocrotophos (Appendix IX) and methidathion (Appendix X), noting that only unchanged insecticide was usually found as the terminal residue of monocrotophos. Mr. ELGAR indicated that the *trans*-isomer of monocrotophos appeared to be very unstable. Dr. TURTLE (FAO) informed the Commission that no further work would be required of it on monocrotophos. Dr. VITOROVIČ informed the Commission that some work was in progress on terminal residues of methidathion in Yugoslavia and Dr. RESNICK indicated that information from studies on methidathion in South Africa should be available next year.

7. Carbaryl and Other Carbamates

Dr. BARON presented a report to the Commission on further knowledge of the terminal residues of carbaryl, *p*-chlorophenyl methyl carbamate, aldicarb, carbofuran, Bux, Matacil, Fectron, Mesurol, Meobal, Banol, UC-34096, and *m*-tertbutylphenyl methyl carbamate (Appendix XI). Several reviews in the general areas of carbamates had been published since 1970, including the monograph on carbofuran appearing in the *Residue Reviews* series that was mentioned in the minutes of the Sixth Meeting of the Commission. Both 2-hydroxycarbaryl (in silk worm) and *N*-hydroxymethyl carbaryl (in cell culture) had been reported as new metabolites of carbaryl, but their existence needed to be confirmed. The Commission's attention was drawn to the (as yet) lack of confirmation of *N*-hydroxymethyl-3-hydroxycarbofuran as a metabolite of carbofuran. There was nothing new to report on the nature of terminal residues of the remaining carbamates listed. The question of whether the Commission would consider the *N,N*-dimethyl carbamates in the future was dependent on the availability of an appropriate reviewer.

8. Fumigants

The Commission expressed its deep appreciation to Mr. W. BURNS BROWN for his past efforts on behalf of IUPAC in initiating needed studies on the nature of terminal residues of fumigants. The Commission heard a contributed report on further knowledge of the terminal residues of fumigants presented by Mr. HEUSER (Appendix XII). The reported occurrence of chloroform in wheat fumigated with carbon tetrachloride appeared to arise from the use of steam distillation in the analytical method; with cold extraction no chloroform was found. Considerable amounts of 2-acetoxyethanol were found in cocoa beans and powder fumigated with ethylene oxide, due to its reaction with acetic acid in the commodities. Dr. HURTIG expressed concern over the nature of terminal residues that might arise from sequential fumigation with multiple fumigants. Dr. RESNICK informed the Commission that tobacco grown in soil fumigated with methyl bromide did not give rise to detectable residues in the smoke of cigarettes. Dr. ABBOTT pointed out that residues of bromide ion should be a subject of the Food Additives and Food Contaminants Commissions of IUPAC. Dr. MAYR indicated that further data on terminal residues of ethylene oxide in foods and on oxyacids of phosphorus, arising from fumigation with phosphine, might be available for the next meeting of the Commission. The Commission considered the question of whether ³²P-labelled phosphine could be validly used in research on terminal residues, and expressed the hope that a definitive answer could be provided at the next meeting.

9. Fungicides

(i) *Dithiocarbamates*. The Secretary presented a report to the Commission prepared by Dr. P. C. KEARNEY on the occurrence and behaviour of ethylenethiourea (ETU), a degradation product of the ethylene bisdithiocarbamate fungicides, nabam, zineb, polyram, maneb, and Dithane M-45 (Appendix XIII). ETU had been detected in formulated materials and as residues in certain food crops. Dr. ABBOTT noted that a gas chromatographic method for the determination of residues of ETU developed by HAINES and ADLER had appeared in *J. Assoc. Offic. Anal. Chem.* [56, 333 (1973)].

(ii) *Organotin Compounds*. Dr. ABBOTT presented a report to the Commission prepared by Dr. SLADE on the terminal residues of organotin compounds (Appendix XIV). Fentin acetate was degraded in soil, 50% being decomposed in 140 days. Most of the total tin remaining 4 weeks after spraying apples and pears with tricyclohexyltin hydroxide was the parent compound, nearly all being in the peel of the fruit.

10. Herbicides

(i) *Dioxins*. The Secretary presented a report to the Commission, prepared by Dr. KEARNEY, on the terminal residues of 2,3,7,8-tetrachloro-dibenzo-*p*-dioxin (TCDD), which occurred as a contaminant in some samples of the herbicide 2,4,5-T (Appendix XV). The detection of TCDD in fish in Vietnam had further deepened the controversy surrounding 2,4,5-T. At present a national TCDD monitoring survey was in progress in USA, using the great sensitivity afforded by the double focussing mass spectrometer equipped with a time averaging computer. The effective range of detection of TCDD was from 10 to 1000 ng/kg after careful cleanup.

(ii) *Diquat*. The Commission received a report from Dr. SLADE on the nature of the terminal residues of diquat (Appendix XVI). The compound was not metabolized in plants. However, rapid photochemical degradation occurred on the surfaces of leaves. The nature of the water-soluble degradation products had not yet been resolved. Diquat was more rapidly photolysed than paraquat. When fed to goats, a trace of radioactivity appeared in the milk, mainly due to incorporation into lactose, fats, and protein.

(iii) *Chlormequat*. The Commission received a prepublication copy of a paper from Dr. DEKHUIZEN entitled 'Distribution and Persistence of Chlormequat in Potato Plants' [H. M. DEKHUIZEN and K. B. A. BODLAENDER, *Pestic. Sci.* 4 (1973) in press]. Chlormequat penetrated the leaves, was translocated to the tubers and, accumulated in the underground parts.

11. Other Compounds

Reports on the nature of the terminal residues of chlordimeform in plants and animals were presented to the Commission by Dr. GEISSBÜHLER (Appendix XVIIa) and by Dr. FUKUNAGA (Appendix XVIIb). The pathways of transformation of chlordimeform in plants and animals were basically the same. However, the mammalian organism appeared to be more versatile in altering the compound. The same terminal residues were found in rice as in other plants.

12. Other Matters

The Commission discussed certain aspects of the conduct of future meetings, especially with regard to the sequence of information exchange with the FAO-WHO Joint Meetings on Pesticide Residues. Dr. TURTLE distributed the list of pesticide compounds on the agenda of the FAO-WHO JMPR to be held in November 1973, and explained the FAO procedure in sending out the compound list to GIFAP, IUPAC, and companies. The Commission agreed to continue to include within its frame of reference compounds of interest because of environmental problems or other scientifically valid reasons.

13. Publication

The Secretary was authorized to arrange for publication of the complete proceedings of the Commission by IUPAC and for a summary to be published in *J. Assoc. Offic. Anal. Chem.*

14. Retirement of Chairman

The thanks and gratitude of the Commission were expressed to Dr. HURTIG, the retiring Chairman, for his valued services and for his role in the establishment of the Commission.

15. Date and Place of Next Meeting

The next meeting of the Commission would be held by courtesy of ICI Plant Protection Ltd. at Jealott's Hill Research Station (Bracknell, UK) during the first week in October 1974.

Appendix I: Terminal Residues of Lindane

Although the requirements of the FAO-WHO JMPR concerning lindane had been met, and in that respect the work of the Commission was finished, a number of unresolved questions of general interest remained to which this report was addressed.

Transformations in Animals. Five previously unreported metabolites from the urine of rats fed lindane had been identified as 3,4-dichlorophenol, 2,4,6-trichlorophenol, 2,3,4,5-tetrachlorophenol, 2,3,4,6-tetrachlorophenol, and 2,3,4,5,6-pentachloro-2-cyclohexen-1-ol by CHADWICK and FREAL (1,2). While the 3,4-dichlorophenol was a minor metabolite, the others were excreted in greater quantities than either of the previously identified metabolites, 2,3,5- or 2,4,5-trichlorophenol. The excretion of tetrachlorophenols and 2,3,4,5,6-pentachlorocyclohexenol required a revision in the current theory regarding the metabolism of lindane in mammals. These same authors also found that the metabolism of ^{14}C -labelled lindane in rats was stimulated by pretreatment with lindane or with DDT and lindane (3). Rats receiving DDT plus lindane excreted significantly more 2,4,5-trichlorophenol and 2,3,4,6- and 2,3,4,5-tetrachlorophenols than rats receiving lindane alone.

The effects of dietary protein and fat and starvation on excretion of accumulated lindane were studied by OSHIBA and KAWAKITA (4,5). Female rats were fed 100 ppm of lindane for 14 days, then a high-protein diet (casein) without pesticides or diets containing different amounts of fat were fed for 6 days. Some groups were starved for 6 days. The excretion of lindane from all organs was extremely rapid on the protein diets and starvation caused excretion of 70–90% of accumulated lindane in 6 days. Studies on the absorption, accumulation, distribution, and excretion of ^{14}C -labelled and unlabelled lindane fed to rats at various levels in a diet low in proteins and fats were reported by OSHIBA (6) and by OSHIBA and KAWAKITA (7). Tissue levels of lindane reached a plateau within 3–7 days. Conditions known to accelerate lipid metabolism markedly, reduced lindane deposited in organs and tissues.

Protein quality and ascorbic acid deficiency were found by CHADWICK, PEOPLES and CRANMER (8) to affect the storage and excretion of ^{14}C -lindane. Low quality dietary protein enhanced urinary but not faecal excretion of

radioactivity. Ascorbic acid deficiency inhibited urinary excretion of radioactivity and permitted a high level to be stored in the kidney. Both qualitative and quantitative alterations in the metabolism of lindane were found.

Transformation in or on Plants. There was little new to report on the nature of the terminal residues of lindane in plants. Further information was available on the uptake from soil, translocation, and persistence of lindane in various fodder crops (9), sugar beets (10), paddy rice (11), rice straw (12), eggplant (13), green tea and its aqueous extract (14), tobacco (15), corn (16), fennel and peppermint (17), and fruits of bhindi (18).

Effects of Processing. Decomposition products of lindane, formed during baking, such as γ -1,3,4,5,6-pentachlorocyclohexene, in a maximum concentration of 0.1 mg/kg, and traces of three different trichlorobenzene isomers; mostly 1,2,4-TCB, were detected in 300 samples of baked cereal products (bread, biscuits, macaroni, and breakfast cereals) analysed by WESTÖÖ, NOREN and ANDERSSON (19).

Transformation in Soil. CLATH and SPENCER (20), in a study on the movement and persistence of dieldrin and lindane in soil as influenced by placement and irrigation, reported the presence in soil of γ -pentachlorocyclohexene, a degradation product of lindane, suggesting that this was a major pathway for the elimination of lindane from soils.

Studies by TSUKANO and KOBAYASHI (21) of incubation of lindane-containing soil under flooded conditions for 6 weeks revealed that 90% was degraded by the end of the sixth week. The presence of a metabolite, identified as γ -3,4,5,6-tetrachloro-1-cyclohexane by melting point, elemental composition, infrared spectrum, and GC retention time, was detected at levels up to a maximum (at 2 weeks) of 2% of the quantity of lindane employed. The degradation of the γ -BTC in flooded soil took place even more rapidly than that of lindane, which probably accounted for the low levels of γ -BTC found.

Reviews. An extensive review by MORRISON (22) of the use and place of lindane in the protection of stored products had appeared. DEMOZAY (23) had summarized the Proceedings of the International Symposium on Lindane held in Vienna on 9 June 1972. The incredible error was made, whether by the Symposium or the summarizer was uncertain, of comparing the ADI of 0.0125 mg/kg (of human body weight) with residue concentrations usually found in food (as mg/kg of food) and concluding that the ADI was 100 times lower than average residues in food.

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Appendix II: Lindane Metabolism in Lettuce under Controlled and Natural Conditions

I. Experiment in Hydroponic Culture

Twelve lettuce plants were grown in a plant growth chamber in a nutrient medium for 9 days. The nutrient medium contained $\text{Ca}(\text{NO}_3)=0.1\%$, $\text{KH}_2\text{PO}_4=0.025\%$, and $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}=0.025\%$. After this time lindane (ca. 30 mio dpm = 12 mg) was applied to the nutrient solution and the plants were allowed to grow further for 4 weeks. The plants and the nutrient solution were worked up separately. Simultaneously, an identical control experiment

was carried out. For control the plants were removed upon lindane application, and the nutrient solution was analyzed after 4 weeks.

(i) *Analysis of Nutrient Medium.* The activity recovered was about 6.1%, based on initial application. TLC was run in benzene-hexane and percentages of the respective zones were determined:

Zone A (polar substances)	ca. 16%
Zone B (lindane)	81-82%
Zone C (substances less polar than lindane)	ca. 2%

The following substances were identified by GLC-MS from Zone C:

- (a) trichlorobenzene
- (b) tetrachlorobenzene
- (c) pentachlorobenzene
- (d) pentachlorocyclohex-1-ene
- (e) dehydrolindane

Zone A on TLC with polar solvent gave two peaks. One of these peaks amounted to 5-6%, based on recovered activity. After methylation, mass spectra of two metabolites were obtained: pentachlorophenol methyl ether (ca. 5%) and a tetrachlorophenol methyl ether (<1%). Work to identify the second original peak of Zone A was in progress.

(ii) *Lettuce Plants.* Based on the applied amount, the recovered activity was 12.4%. From TLC analysis the following percentages were found:

Zone A (polar substances)	ca. 19-20%
Zone B (lindane)	76-77%
Zone C (substances less polar than lindane)	ca. 3%

In Zone C the same compounds had been identified as in the respective zone of the analysis of the culture medium. Zone A on TLC with polar solvent gave two peaks. One of these peaks was about 1%, based on recovered activity. After methylation, it could be identified as 2,3,4,6-tetrachlorophenol methyl ether.

(iii) *Analysis of Control Experiment.* The total activity recovered was about 15.6%. TLC showed most of the radioactivity as lindane. None of the metabolites reported above had been detected in this experiment.

II. Experiment with Lindane on Lettuce under Natural Conditions

Lettuce seedlings (24) were planted in a box and allowed to grow for 8-10 days. Lindane (ca. 23 mio dpm=12 mg) was applied to the leaves. After 4 weeks the plants were homogenized, extracted first with benzene in the cold, then soxhleted with methanol.

(i) *Benzene Extract.* The total activity recovered was 4.3%, based on applied activity. TLC of this fraction gave again 3 zones:

Zone A (polar substances)	11-12%
Zone B (lindane)	85-86%
Zone C (substances less polar than lindane)	2-2.5%

The following substances were identified from Zone C by GLC-MS:

- (a) trichlorobenzene
- (b) tetrachlorobenzene
- (c) pentachlorobenzene

(ii) *Methanol Extract*. The total activity recovered was 3.3%, based on applied activity. The extract was evaporated, taken up in water, and extracted thoroughly with ether. The activity in the ether extract was about 33% of the methanol extract. TLC of the ether extract gave the following zones:

Zone A (polar substances)	50-51%
Zone B (lindane)	47-48%
Zone C (substances less polar than lindane)	0.5%

Further work to identify the polar substances was in progress.

Appendix III: Terminal Residues of Hexachlorobenzene

There continued to be a lack of any experimental evidence to indicate that hexachlorobenzene was metabolized by plants, animals, or soil microbes, or that it was degraded into any other product in the environment.

In a study resulting from accidental contamination of milk, GOURSAUD *et al.* (1) found that the source of the contamination appeared to be endive roots used as cattle feed and which had been treated, during growth, with the fungicide PCNB. The commercial formulation used contained 30% PCNB and 3% HCB. When milk cows were experimentally fed diets containing 2 mg/day of HCB and 25 mg/day of PCNB, progressive increases in the HCB content of the milk resulted, which reached 2 ppm on the seventh day. Only traces of PCNB were found in the milk.

In a series of feeding experiments involving sheep, laying hens, and growing chickens, AVRAHAMI and STEELE (2,3,4) found that dietary levels of HCB ranging from 0.1 to 100 ppm resulted in rapid accumulation in omental fat (sheep), body fat (chickens and laying pullets), and egg yolk. Sheep stored HCB in body fat to the extent of 7-9 times the feed level at all levels tested. The half-life of HCB in fat appeared to be 10 and 18 weeks. For chickens and pullets, the fat:feed ratio ranged from 31:1 to 20:1 with increasing feed concentration. Egg yolk concentrations were about 25% of those in the corresponding body fat.

Mention was made by STIJVE (5) of some evidence for partial degradation of hexachlorobenzene in chicken fat samples during a survey of residues in cereals, fats, and dairy products, using improved analytical methods. However, no controlled experiments were carried out.

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Appendix IV: Terminal Residues of Cyclodiene Insecticides

I. Aldrin and Dieldrin

A great deal of information was available regarding the metabolites and breakdown products of aldrin and dieldrin, and new studies were still going forward in a number of locations. The following paragraphs briefly summarized the currently available facts.

(i) *Mammals*. The excretion products of aldrin and dieldrin in eight species of animals were indicated in Table 1. The structures were shown in Fig. 1. Aldrin (I) was rapidly converted to dieldrin (II) in all animals studied, and it appeared that other metabolites of aldrin were common with dieldrin. The most important animal metabolite was 9-hydroxydieldrin (III), which seemed universal, with the possible exception of the rabbit in which it appeared to be a minor product. The 9-hydroxydieldrin was eliminated in the bile in conjugated form. The conjugate was hydrolyzed in the intestine and 9-hydroxydieldrin was excreted in the faeces. In some animals 9-hydroxydieldrin was excreted in the urine. It had not been found to store in tissues to any appreciable extent. The dihydroaldrin diol (IV) was also a common excretion product. Dihydrochlordene dicarboxylic acid (V) was probably formed to some extent in all species, and it was excreted in the urine and faeces. It was a known metabolite of the dihydroaldrin diol (IV) (ODA and MULLER, 1970), and its presence in the urine suggested that the diol was produced and oxidized to the diacid.

The pentachloroketone (VI) was a minor metabolite, and it was only appreciably excreted in the urine of male rats. It was not excreted by female rats. The pentachloroketone (VI) was stored in the organs of the male rat, but none was found in the tissues of female rats (MATTHEWS *et al.*, 1971). Further information on this compound was provided by data from feeding studies with photodieldrin discussed in a later section.

The acid metabolite X-3 was found to be an important component of mouse urine (BALDWIN *et al.*, 1972), but accounted for a relatively small proportion of the total excretion products of dieldrin. Recent investigations (HUTSON, unpublished) had shown that X-3 was a complex mixture of about five metabolites, one of which was 9-hydroxydieldrin glucuronide. The mixture was found in rat urine in one study in very small amounts, but its presence was considered doubtful in subsequent studies.

While the elimination of dieldrin from the bodies of animals was not truly logarithmic, it had generally been found nearly so, especially after an initial period of rapid decline. As a rough indication of the rates of metabolism, half-lives for elimination had been estimated from the available data (see Table 1). Most notable was the extremely slow elimination reported for the rabbit (KORTE and ARENT, 1965). Perhaps this resulted from the fact that hydroxylation at the 9-position was a minor or nonexistent pathway in rabbits. It should be emphasized that this long half-life was based on elimination of carbon-14 rather than dieldrin, and it was dependent on counting efficiency to some extent. Further studies should be made in the rabbit to confirm this result.

The fate of dieldrin in the rat had been particularly well studied, and the recent publications of MATTHEWS and MATSUMURA (1969), MATTHEWS *et al.* (1971), MCKINNEY *et al.* (1972), and BALDWIN *et al.* (1970, 1972) provided a very complete picture. Metabolism in the female rat compared well with that in other species. Male rats seemed unique in their ability to form the

Table 1. Excretion products of aldrin and dieldrin in mammals

Species	HEOD (II)		9-OH-HEOD (III)		6,7-Dihydroal- drin diol (IV)		Dihydrochloro- dine dicarboxylic acid (V)		"Pentachloro- ketone" (VI)		Acid metabolite X-3		Approx. half-life of dieldrin in animal, days	References
	Urine	Faeces	Urine	Faeces	Urine	Faeces	Urine	Faeces	Urine	Faeces	Urine	Faeces		
Mouse CFI	0	+	0	+	(Major)	+	+	0	0	0	+	(Major)	10.6	6
Rat	+	+	0	+	(Major)	+	+	0	+	Males 0 Females	+	(6) 0 (84)	11 Males 100 Females	4,6,7,21,37,49, 52,53,55,71
Rabbit	-	-	-	+	(Major)	+	-	-	0	-	-	-	431 ^a	42,67
Dog	-	-	+	+	+	-	-	-	+	-	-	-	81 ^d 44 ^e	67,70,80
Sheep	-	-	+	+	(Major)	-	-	-	-	-	-	-	20-30 ^b 35(parous) ^g 44(nonparous) ^g	24,27,79
Cow	0	+	-	-	-	-	-	-	0	0	-	-	50 ^e 84 ^f	17,64,82
Rhesus monkey	0	+	+	+	(Major)	-	-	-	0	0	+	-	-	5
Man V. low	+	+	0	+	(Major)	0	+	0	0	0	-	-	369 266	30,34,68,69

^a Estimated from data of KORTE and ARENT (42)^b Crudely estimated from data of HEDDE *et al.* (27)^c Estimated from fat contents at 4 and 6 weeks in (82)^d Estimated from blood levels of (80)^e Estimated from blood levels of (70)^f Calculated from data of (17) by POTTER (64)^g Estimated from VARELA-ALVAREZ *et al.* (79)0 Indicates absent
+ Indicates present
- Not looked for

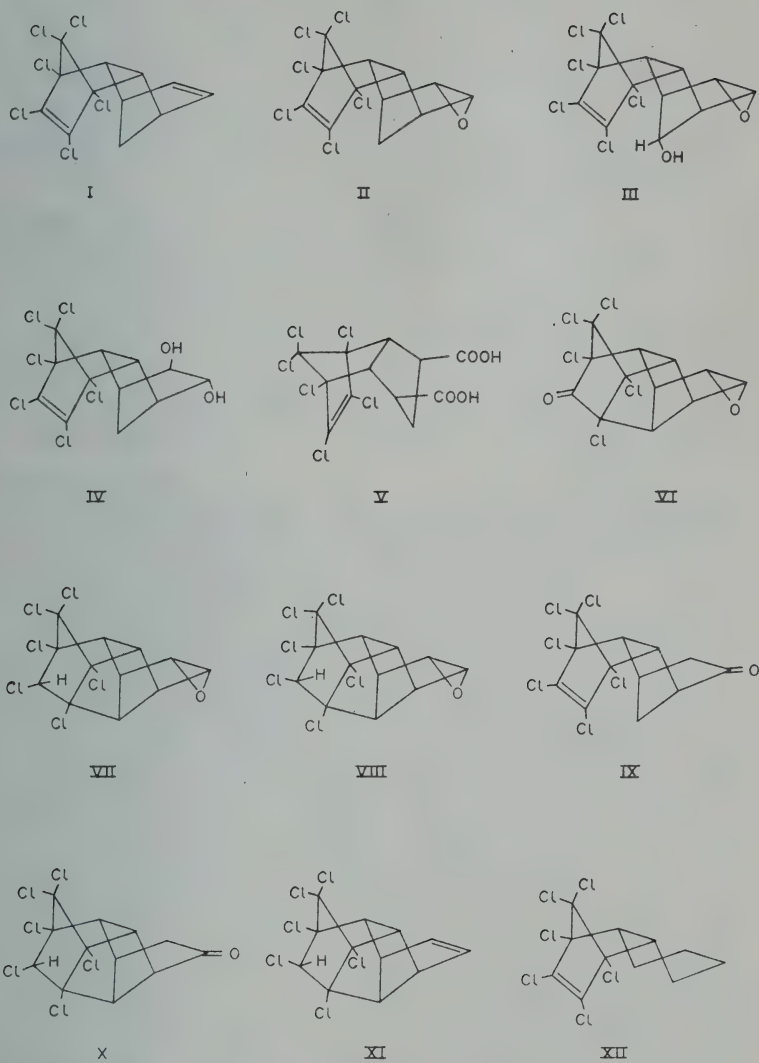


Fig. 1. Structures of aldrin, dieldrin, and their metabolites and degradation products.

pentachloro ketone (VI) (a minor metabolite even for male rats). They stored this compound in their livers and kidneys, and excreted it in the urine. The mechanism by which it formed was not yet clear, but strong clues were provided by the work of MATTHEWS *et al.* (1969, 1971). They found that a suitably optimized preparation of male rat liver microsomes was capable of transforming dieldrin to both the 9-hydroxydieldrin (III) and the pentachloro ketone (VI), but the main product was a new compound, which they designated M-6 and which was principally formed in their system as a glucuronic acid conjugate. Based on its properties, they suggested the structure (VII) in Fig. 1. The M-6 compound was reported to convert spontaneously to pentachloro ketone (VI) on standing in a refrigerator. This observation did not seem consistent with the structure shown, but suggested that a chlorine and hydroxyl (or perhaps hydroperoxide) might be both attached to the unbridged carbon atom.

Lactating cows were fed ¹⁴C-labelled dieldrin at the Shell laboratories in Modesto, California. The compound was administered in a grain supplement at a rate corresponding to 0.2 ppm on the whole diet (POTTER *et al.*, 1973). After 41 days known metabolites were undetected in tissues at a sensitivity level of about 0.004 ppm equivalents. All carbon-14 in the tissues was accounted for by dieldrin. The same was true of milk which contained an average of 0.036 ppm equivalents of carbon-14, with no significant difference between carbon-14 and dieldrin content measured by GLC. None of the known metabolites was detected in the milk at sensitivities about 0.003 ppm equivalents.

Special interest in the metabolism of photodieldrin (VIII) arose because it was a likely step in the formation of the pentachloro ketone (VI), and it was a possible residue of aldrin or dieldrin under circumstances in which the compounds were exposed to sunlight as, for example, following foliar applications or surface applications to soils. KLEIN *et al.* (1969) demonstrated that photodieldrin was transformed to hydrophilic metabolites in both rats and rabbits. BALDWIN and ROBINSON (1969) fed photodieldrin (VIII) to rats and found that both the parent compound and the pentachloro ketone (VI) were stored in the tissues. GEORGACAKIS *et al.* (1971) showed that several freshwater animals also formed the pentachloro ketone (VI) from photodieldrin. DAILEY *et al.* (1970) administered photodieldrin to both male and female rats and found a striking difference in tissue storage and rate of excretion with sex. KLEIN *et al.* (1970) analyzed the urine from photodieldrin-treated rats and found that male rats excreted pentachloro ketone (VI) in the urine, whereas female rats excreted no detectable pentachloro ketone (VI). About half of the carbon-14 in the urine of the female rats was extractable with ether. The ether extracts contained at least four components. DAILEY *et al.* (1972) administered photodieldrin to normal male and female rats and to castrated males and oophorectomized females. Biopsy samples of adipose tissue showed higher levels of pentachloro ketone (VI) in females, castrated males, and oophorectomized females than in normal males. In spite of this, the former three groups did not excrete pentachloro ketone (VI), whereas normal males did. On administering testosterone to all groups, no change occurred in normal males, but the other three groups began excreting the pentachloro ketone (VI).

When dieldrin was fed to male and female rats (MATTHEWS *et al.*, 1971), no pentachloro ketone (VI) was found in tissues of females, whereas it was found in many of the tissues of the male rats. If the formation of photo-

dieldrin was a first step in the conversion to pentachloro ketone, this would imply that male rats were unique in their capability to form photodieldrin. On the other hand, the distribution of pentachloro ketone in the tissues of male rats from dieldrin feeding was substantially different from that resulting from photodieldrin feeding. Further, no photodieldrin had been found in tissues of dieldrin-fed animals. These facts argued for a more direct route to pentachloro ketone from dieldrin, not involving the photodieldrin as an intermediate.

Little information was available on the metabolism of other aldrin-dieldrin metabolites in animals. The dihydroaldrin diol (IV) was rapidly excreted as the parent compound and its conjugates, but it was also metabolized to the diacid (V) (ODA and MULLER, 1970). KORTE and his associates had injected rats intravenously with carbon-14 labelled dihydrochlordene dicarboxylic acid (V). They found 87% of the carbon-14 excreted within 5 days, principally as the parent compound and its conjugates.

HUTSON (1972) fed two lactating cows twice daily for 21 days with carbon-14 labelled dihydrochlordene dicarboxylic acid (V) at a rate corresponding to 0.5 ppm in the diet. Excretion was almost completely via the urine and faeces. Radioactivity in milk was too low for accurate measurement, but represented less than 0.001 ppm equivalents of (V). At the end of the feeding period livers contained 0.0016 and 0.0034 ppm equivalents, kidneys 0.0095 and 0.0047 ppm equivalents, and all other tissues were below 0.003 ppm equivalents. The excretion of the dihydrochlordene dicarboxylic acid was rapid and complete.

(ii) *Soils and Microorganisms.* Microorganisms from various sources were capable of transforming aldrin and dieldrin to other products. Those products which had been identified as produced by cultures from soils and other environmental sources were the dihydroaldrin diol (IV) (WEDEMEYER, 1968; MATSUMURA *et al.*, 1968; TU *et al.*, 1968), dieldrin photo-isomer (VIII) (LICHTENSTEIN, 1970a; MATSUMURA, 1970), dieldrin ketone isomer (IX) (MATSUMURA *et al.*, 1968; BIENIEK *et al.*, 1969), and the photo-isomer of dieldrin ketone (X) (MATSUMURA *et al.*, 1968; BIENIEK *et al.*, 1969). Other products had been observed, including highly polar acidic materials, but they had not been identified. BIXBY *et al.* (1971) observed that dieldrin was degraded to carbon dioxide by *Trichoderma koningi*. SCHUPHAN and BALLSCHMITER (1972) studied metabolism of polychlorinated norbornenes by *Clostridium butyricum* and found that dechlorination of the chlorinated ring could be accomplished by the microorganism, rendering the ring susceptible to further attack.

Aldrin and dieldrin were accumulated from water by algae and marine microorganisms (PATIL *et al.*, 1972; LESHNIOWSKY *et al.*, 1970; RICE *et al.*, 1973; ROSE *et al.*, 1970; ELSNER *et al.*, 1972). PATIL *et al.* (1972) found that aldrin and dieldrin were metabolized by marine microorganisms to both photodieldrin (VIII) and the *trans*-diol (IV) as well as to other unidentified metabolites. ELSNER *et al.* (1972) found that the green algae *Chlorella pyrenoidosa* was capable of the surprising transformation of aldrin to 1,2,3,4,9,9-hexachloro-1,4,4a,5,6,7,8,8a-octahydro-1,4-methanonaphthalene (XII).

In soils, aldrin and dieldrin were degraded by microorganisms and evidence had been found that the breakdown could proceed all the way to carbon dioxide and chloride ion (STOJANOVIC *et al.*, 1972; JAGNOW *et al.*, 1972). The products mentioned above had all been found in soils, but at the present time no quantitative accounting of the conversions of aldrin had been made under actual field use conditions. A very important study of the fate of ¹⁴C-aldrin in soils which, although not a field study was done under outdoor conditions,

had been going on for some time under the direction of KORTE. The Shell laboratories in UK and USA had also contributed to certain aspects of the work. Results had been reported in several places (KORTE *et al.*, 1971, 1972; MOZA *et al.*, 1972; KLEIN *et al.*, 1972, 1973). These studies had shown that aldrin incorporated into the soil was converted to a number of metabolites. One important metabolite not previously reported was the dihydrochlordene dicarboxylic acid (V). Over a period of 3 years, approximately 10% of the initially applied aldrin was found as the diacid in leach water below 60 cm of soil. In the treated soil samples photodieldrin (VIII) and photoaldrin (XI) were also detected in small amounts and another very hydrophilic component was found but not as yet identified. Similar experiments carried out with dieldrin showed much lower rates of conversion to hydrophilic metabolites, and only traces of the diacid in leach water.

KORTE and his associates were continuing their studies of the terminal metabolism of aldrin and dieldrin in soils. Two items of interest from their laboratories in relation to fates of known metabolites were the following:

Trans-dihydroxydihydroaldrin. *Trans*-dihydroxydihydroaldrin was known to be a major metabolite of aldrin and dieldrin in mammals. Some years ago, it was shown in this laboratory that it was not the end product of aldrin metabolism. After application of the radiolabelled diol to mammals, it was found to be oxidized to dihydrochlordene dicarboxylic acid; in microorganisms, too, the formation of a highly hydrophilic metabolite was observed. To elucidate the fate of *trans*-dihydroxydihydroaldrin in higher plants and soil, the ^{14}C -labelled compound was synthesized again and applied to soil and to lettuce leaves, in a climate room. In soil, more than 70% of the recovered radioactivity was due to hydrophilic compounds, mainly to dihydrochlordene dicarboxylic acid, after 7 weeks. In lettuce leaves, after 4 weeks, about 40% of the radioactivity which had penetrated them after foliar application, was due to hydrophilic metabolites; the main product was dihydrochlordene dicarboxylic acid again.

Dihydrochlordene Dicarboxylic Acid. As most metabolism experiments with aldrin and its metabolites had suggested the formation of dihydrochlordene dicarboxylic acid up to now, experiments were started to find out whether this compound was indeed the final product of aldrin metabolism. The acid was synthesized in ^{14}C -labelled form and applied to rats, mosquito larvae, soil microorganisms, and maize. In rats, after intravenous injection, 87% of the radioactivity was excreted within 5 days. The excreted radioactivity consisted of the unchanged acid as well as of several metabolites, some of which were, however, only conjugates of the unchanged acid. Less than 10% of the dihydrochlordene dicarboxylic acid applied to water was metabolized by mosquito larvae within 72 hours and, also, less than 10% by soil microorganisms within 3 weeks. After application of dihydrochlordene dicarboxylic acid to the leaves of young maize plants, the plants were cultivated in a climate room and worked up when they had developed cobs. Besides the unchanged acid, conjugates of the unchanged acid were detected, as well as conjugates of a degradation product; the latter substance, however, amounted only to 2% of the total radioactivity recovered. All these experiments showed that dihydrochlordene dicarboxylic acid was not the final product of aldrin metabolism.

(iii) *Degradation in Air.* A review of pesticide residues in the atmosphere by JEGIER (1969) summarized pertinent references on aldrin and dieldrin up to 1969. The potential volatilization from soil applications had been demon-

strated by a number of investigators; however, the translation of their results to meaningful estimates of vapour losses had not been satisfactorily accomplished. (LICHTENSTEIN *et al.*, 1970b; FARMER *et al.*, 1972; IGUE *et al.*, 1972; CARO, 1971; CARO and TAYLOR, 1971; ATKINS and EGGLETON, 1970). Recent air monitoring studies carried out under the US Environmental Protection Agency (YOBS, 1972) had shown traces of aldrin and dieldrin in ambient air over USA ranging from less than 0.1 ng/m^3 to a few isolated instances as high as 25 ng/m^3 . Mean values reported were in the range of 0.2 to 2.4 ng/m^3 .

The content of the air could be recognized as an operating holdup representing a balance between rates of volatilization and rates of recondensation and breakdown. Available data for photochemical degradation indicated that removal by these processes was very substantial and focused a great deal of interest on photochemical products.

Both aldrin and dieldrin underwent photolysis in sunlight; their photochemistries had been recently reviewed by PLIMMER (1971). While the mechanisms of the photochemical reactions had not been worked out in detail, it was clear that the primary processes were due to the formation of excited triplet states. These excited triplets had free radical properties and led to rearrangements or reaction with solvent molecules or other materials depending upon the conditions of irradiation. In general, when concentrated solutions or film deposits of aldrin or dieldrin were irradiated, the products were complex and included a proportion of tarry high molecular weight materials. Reverse Diels-Alder reactions which contributed strongly to the mass spectra of aldrin and dieldrin, undoubtedly played an important part in the formation of tars. Like most compounds whose photochemical reactions depended on an activated triplet state, the photolyses of aldrin and dieldrin were highly sensitized by compounds having similar triplet energies. Especially suitable for sensitization for preparative purposes were acetophenone and acetone (FISCHLER *et al.*, 1969), but naturally occurring materials were also effective sensitizers (IVIE *et al.*, 1970).

The primary photochemical reactions of aldrin were shown in Fig. 2. Isomerization to "photoaldrin" (XI) could be carried out in high yield in the absence of oxygen. Photooxidation of aldrin to dieldrin, and photoaldrin to photodieldrin, proceeded readily in the presence of oxygen. The dechlorination reaction (HENDERSON *et al.*, 1967) required somewhat shorter wavelengths of light than were present in sunlight at the earth's surface; however, it might be important at high altitudes. The rate of conversion of aldrin in sunlight depended on the ambient conditions; however, the order of magnitude could be inferred from the 3-day irradiation of a thin film by ROSEN and SUTHERLAND (1967). They found that only 13% of the aldrin remained, while conditions were such that inappreciable volatilization occurred. This corresponded to a first order rate of about 0.06 hr^{-1} . The photochemical processes which occurred in the vapour phase in air were probably important. MOILANEN and CROSBY had devised an elaborate apparatus and technique for measuring such vapour phase photochemistry free from the effects of surface catalysis (MOILANEN *et al.*, 1972). On irradiating aldrin vapours in air with light closely approximating sunlight, they found both dieldrin and photoaldrin to be formed (CROSBY *et al.*, 1973). Adjusting for the aldrin content of the light path the rate of conversion of aldrin to dieldrin was 0.0173 hr^{-1} , and the rate of conversion to photoaldrin was 0.0087 hr^{-1} . Applying their apparatus to vapours of photoaldrin showed a conversion of this material to photodieldrin at a rate of about 0.007 hr^{-1} .

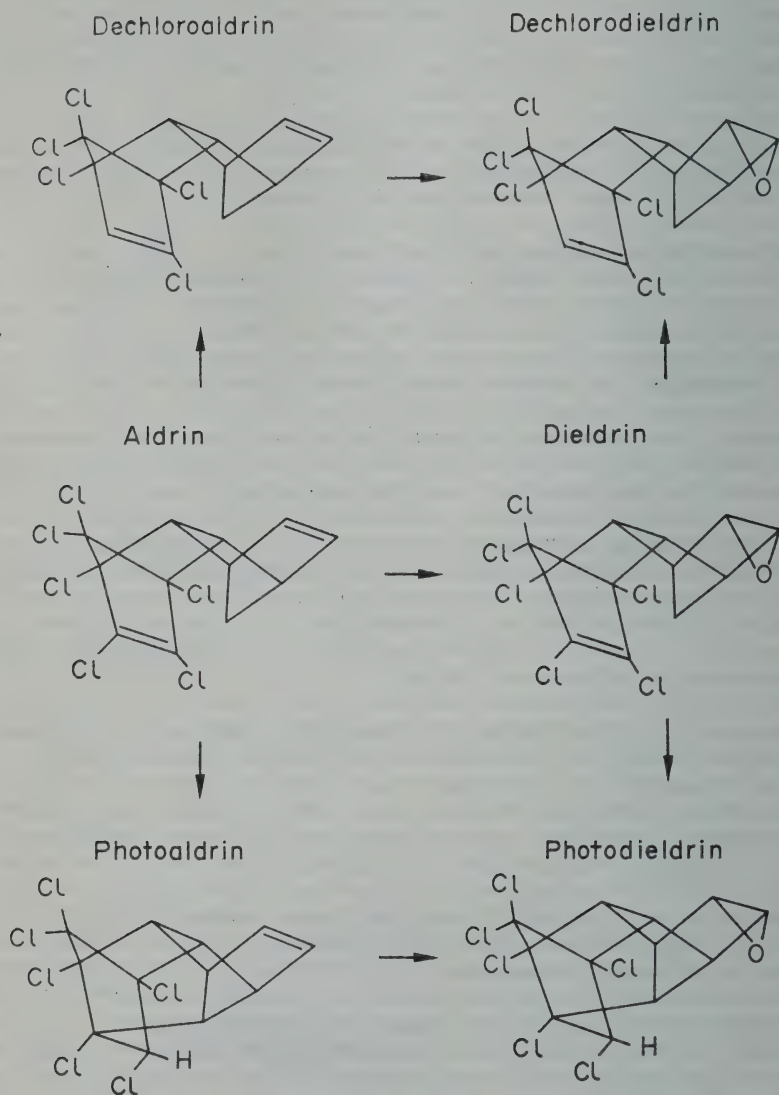


Fig. 2. Primary photochemistry of aldrin.

When dieldrin was irradiated in films or on foliage, photodieldrin was a principal product. The photodieldrin was relatively stable to light. Other products including tars were formed, depending on the circumstances. BENSON (1971) irradiated dieldrin in thin layers with radiation at an intensity of about 400 microwatts per square centimeter. The light source used was not a good representation of sunlight, but an estimate of breakdown rate might be made based on his observation. Natural sunlight aggregated about 2 microwatts per square centimeter in the wavelength range to which dieldrin was susceptible (HIRT *et al.*, 1960). Because BENSON found 75% conversion in 1 hour, the adjustment for natural sunlight intensity suggested a breakdown rate of about 0.01 hr^{-1} . MOILANEN and CROSBY (MOILANEN *et al.*, 1972; CROSBY *et al.*, 1973) in their vapour phase photolysis apparatus found that dieldrin was converted to photodieldrin at rates corresponding to 0.04 hr^{-1} to 0.05 hr^{-1} . Their studies with photodieldrin showed that if further transformation occurred, the rate was below 0.00006 hr^{-1} .

The complexity of the photochemistry of aldrin and dieldrin had been further demonstrated by NAGL and KORTE (1972), who had studied the reactions of dieldrin with nitrogen dioxide and ozone as indications of the interactions of the pesticides with smog. Under various conditions the structures depicted in Fig. 3 were isolated. Owing to the low probability of admixture of appreciable concentrations of aldrin or dieldrin with photochemical smog, these products were not likely to be important as environmental contaminants.

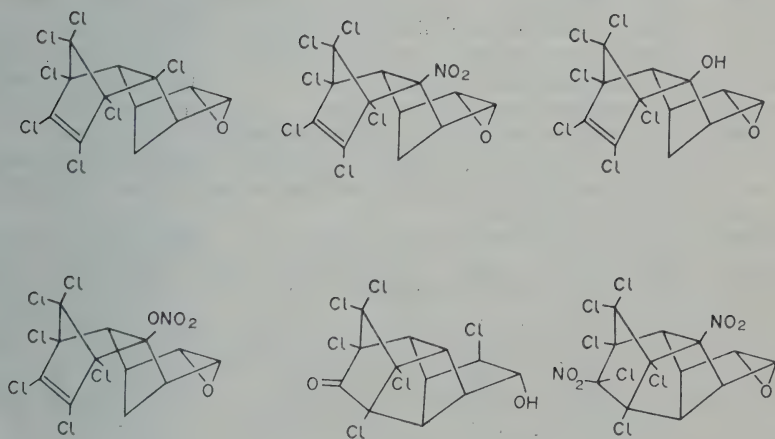


Fig. 3. Products of reaction of dieldrin with nitrogen dioxide and ozone (NAGL and KORTE, 1972).

(iv) *Availability of Standards.* Methods for synthesis of some of the metabolites of aldrin and dieldrin had been reported as follows:

- 9-hydroxydieldrin (III)—BEDFORD and HARROD (1972a)
- 6,7-dihydroaldrin diol (IV)—KORTE and ARENT (1965); BEDFORD and HARROD (1972b)
- dihydrochlordene dicarboxylic acid (V)—LAY (1971)
- rat-urine metabolite, pentachloroketone (VI)—No convenient method of synthesis had been reported; however, a possible route was provided by irradiation of dieldrin in the presence of nitrogen dioxide (NAGL and KORTE, 1972)
- metabolite M-6 (VII)—No method of synthesis had been reported. *In vitro* preparation was possible by the method of MATTHEWS *et al.* (1969, 1971)
- photodieldrin (VIII)—FISCHLER and KORTE (1969); BENSON (1971)
- dieldrin ketone (IX)—SKERRETT and BAKER (1959, 1960)
- dieldrin ketone photo-isomer (X)—BIENIEK and KORTE (1969)
- photoaldrin (XI)—FISCHLER and KORTE (1969)
- green algae metabolite (XII)—RIEMSCHEIDER and KUHN (1947).

II. *Cyclodiene Insecticides other than Aldrin and Dieldrin*

ARCHER (1973) measured residues of endosulfan and its breakdown products on alfalfa hay exposed to drying by sunlight, ultraviolet light, and air. No endosulfan lactone was found. The endosulfan sulfate was an important terminal residue even in absence of light. Residues were present of endosulfan diol, ether, and α -hydroxyether.

STREET and BLAU (1972) studied accumulation of oxychlordane in rat adipose tissue on feeding chlordane isomers or technical chlordane. Female and male rats stored less oxychlordane from the *cis*-isomer than from *trans*. Females stored markedly more oxychlordane than males. For both sexes the accumulation of oxychlordane in the adipose tissue was greater than for either chlordane isomer.

BENSON (1971) reported on photolysis of technical chlordane and some of its pure components. Chlordene, *cis*-chlordane, heptachlor, and heptachlor epoxide were converted to cage and half-cage structures. Other components, *trans*-nonachlor, *trans*-chlordane, and β -dihydroheptachlor photolyzed but products were not identified. MCGUIRE *et al.* (1972) also considered the photochemical reactions of heptachlor. Formation of the cage structure predominated with acetone as a sensitizer, and with longer wavelength ultraviolet light. At shorter wavelengths dechlorination reactions and solvent additions occurred.

WILSON *et al.* (1972) reported finding oxychlordane, 1,2-dichlorochlordene, and photo-*cis*-chlordane as well as the chlordane isomers in alfalfa grown in soils treated with high purity chlordane [greater than 95% α -(*cis*) and γ -(*trans*) chlordane]. This was the first report of the formation of oxychlordane in soil or a crop. About 4 months after soil treatment at 5 lb per acre, alfalfa contained about 0.09 ppm of chlordane isomers, 0.015 ppm of oxychlordane, and 0.01 ppm of photo-*cis*-chlordane. The authors found no oxychlordane in the soil and therefore suggested that it was formed in the alfalfa.

CARTER *et al.* (1971) isolated 1-hydroxy-2,3-epoxychlordene in soil previously treated with heptachlor. CHAU *et al.* (1971) provided methods of synthesis for 1-hydroxychlordene, 1-ketochlordene, and photoheptachlor-ketone.

NASH and BEALL (1971) reported finding endrin, δ -keto isomer (endrin photo-isomer) and the endrin "bird-cage" alcohol in soybean plants grown in soil treated with ^{14}C -endrin. Identifications were based on GLC and TLC comparisons with standards.

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Appendix V: Terminal Residues of Chlorobenzilate

Since the last review of chlorobenzilate by this Commission in 1971, a single volume on the carbinole acaricides chlorobenzilate and chloropropylate had been published by *Residue Reviews* (1). However, no significant new data on the metabolism and/or terminal residues beyond those already discussed had been included in this monograph. More recent experiments with GLC analytical methods demonstrated that although treated white and red grapes had residues of the order of 1-3 ppm, no chlorobenzilate (<0.05 ppm) was detected in wine prepared from these grapes (2). When cows were fed daily rations of 50 mg of chlorobenzilate for a period of 42 days, residues in milk were consistently below 0.03 ppm, except for one single sample which had 0.03 ppm (2). Residues of the two potential metabolites 4,4-dichlorobenzilic acid and 4,4-dichlorobenzophenone were not detectable (<0.02 ppm).

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Appendix VI: Terminal Residues of Some Organophosphorus Compounds

Methyl Parathion and Azinphosmethyl. Residues on cotton of methyl parathion and Guthion (azinphosmethyl) application at 1.0 lb/acre and 0.5 lb/acre, respectively, gave residues immediately after application of 106 and 40.2 ppm. At the end of 96 hours the residues on the plants were 3.9 ppm and 9.0 ppm, respectively, with only methyl paroxon present in measurable quantities (1). Using infrared techniques for determining residues of some organophosphorus insecticides, it was shown that azinphosmethyl and EPN were recovered from a leaf surface of cotton, while fenitrothion penetrated rapidly (2). The uptake of ^{14}C -benzoid-labelled azinphosmethyl by beans and barley was studied. The major component after cleanup of the plant shoot extract accounted for 97.7% of the total shoot radioactivity with two unidentified components representing 0.7 and 1.6% of the remaining radioactivity (3).

Parathion. The persistence of parathion on cotton plants showed no previously unreported metabolites. However, there was a constant increase of photoalteration products coupled with a consistent decrease in parathion (4). A detailed study of ^{14}C -parathion and ^{14}C -paraoxon metabolism with fractions and subfractions of rat liver cells showed that different enzymes in the rat liver catalyzed the degradation and detoxification of both compounds (5). In submerged soils, parathion was reduced largely to aminoparathion. On inoculation with *Flavobacterium sp.*, hydrolysis largely occurred (6).

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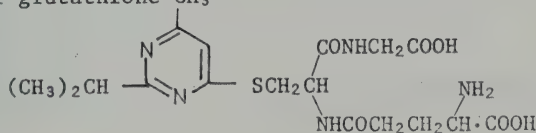
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Appendix VII: Terminal Residues of Some Organophosphorus Compounds

Diazinon. The fate of orally administered ^{14}C -ring-labelled diazinon in mice (50 mg/kg and 75 mg/kg) was studied by MIYAZAKI *et al.* (1). As chloroform-soluble metabolites in urine, the following bioactive triesters were identified: diazoxon, hydroxydiazinon (*O,O*-diethyl *O*-[2-(2-hydroxy-2-propyl)-4-methyl-6-pyrimidinyl]phosphorothioate), isohydroxydiazinon (*O,O*-diethyl *O*-[2-isopropyl-4-hydroxymethyl-6-pyrimidinyl]phosphorothioate), formyldiazinon (*O,O*-diethyl *O*-[2-isopropyl-4-formyl-6-pyrimidinyl]phosphorothioate), isopropenyldiazinon (*O,O*-diethyl *O*-[2-isopropenyl-4-methyl-6-pyrimidinyl]phosphorothioate). These metabolites appeared within 1 hour after administration and reached the maximum 6 hours after treatment. Hydroxydiazinon was recovered from blood (1.9 ppm), liver (2.1 ppm), fat (9.2 ppm), *etc.*, when sheep were orally administered with 1g/kg of diazinon. The highest concentration in urine was observed between 2 and 4 hours after dosing. Isohydroxydiazinon reached the maximum level (38 ppm) in sheep urine within 4 hours after administration (2-4).

	X	R'	R''
diazinon	S	CH ₃	CH(CH ₃) ₂
diazoxon	O	CH ₃	CH(CH ₃) ₂
hydroxydiazinon	S	CH ₃	COH(CH ₃) ₂
hydroxydiazoxon	O	CH ₃	COH(CH ₃) ₂
isohydroxy-diazinon	S	CH ₂ OH	CH(CH ₃) ₂
isopropenyl diazinon	S	CH ₃	C(CH ₃)=CH ₂
formyldiazinon	S	CHO	CH(CH ₃) ₂

pyrimidinyl glutathione CH₃



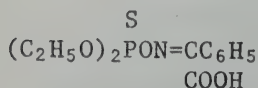
BIOTRANSFORMATION PRODUCTS OF DIAZINON

By the action of mixed function oxidase in the microsomal fraction of rat liver and cockroach fat body, ^{14}C - and ^{32}P -diazinon was oxidized to diazoxon, hydroxydiazinon, hydroxydiazoxon, 2-isopropyl-4-methyl-6-pyrimidone, 2-(2'-hydroxy-isopropyl)-4-methyl-6-pyrimidone, unidentified pyrimidine metabolite, *O,O*-diethyl phosphorothioic acid, *O,O*-diethyl phosphoric acid (5). Diazinon and diazoxon cleaved and conjugated with glutathione by the action of soluble glutathione *S*-transferase of the rat and American cockroach. *S*-(2-Isopropyl-4-methyl-6-pyrimidinyl) glutathione was identified (6). The presence of desethyl diazinon and *S*-ethyl glutathione were established *in vitro* metabolism by house fly (7).

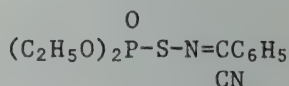
Azinphosmethyl. LIANG *et al.* (8) investigated photodecomposition of azinphosmethyl- ^{14}C . Benzazimide, anthranilic acid, methylbenzazimide sulfide, *N*-methyl benzazimide, and four unidentified products were formed by UV light (2537 Å) irradiation. These metabolites showed noninsecticidal activity. When the temperature was higher than 37° and the pH was larger than 11, azinphosmethyl rapidly degraded to metabolites mentioned above, in addition to a trace amount of mercaptomethyl benzazimide and the oxygen analogue of azinphosmethyl. Yellow (5889 Å) and red (6563 Å) light did not attack this insecticide. By the enzyme action of mouse liver and insect homogenate (mixed function oxidase systems and glutathione *S*-alkyl-transferase), the oxygen analogue of azinphosmethyl, desmethyl azinphosmethyl, *S*-methyl glutathione, dimethyl phosphorothioic acid, and dimethyl phosphoric acid were formed (9-11).

CN-containing Organophosphorus Insecticides. (i) Cyanox (*O,O*-dimethyl *O*-4-cyanophenyl phosphorothioate, acute oral toxicity to mouse $\text{LD}_{50}=580$ mg/kg). Radioactivity was excreted in urine (90%) and faeces (10%) within 96 hours when mice were orally administered with 50 mg/kg of ^{14}C -cyanox. Desmethylcyanox, demethylcyanoxon, *p*-cyanophenol, and *p*-cyanophenyl sulfate were reported as metabolites (12).

(ii) Phoxim (phenyl glyoxynitrile oxime *O,O*-diethylphosphorothioate, acute oral toxicity to rat $\text{LD}_{50}=8500$ mg/kg). When rats were orally administered with ^{32}P -phoxim, excretion of phosphorus-32 to urine was comparatively slow. By the treatment of 955 mg/kg, only 17% of the radioactivity was recovered from urine within 30 hours. Total excretion of phosphorus-32 from rat urine and faeces was 73-82% when 10.5-955 mg/kg of phoxim were dosed. The following metabolites were identified: diethylphosphoric acid, phoxim carboxylic acid, *O,O*-diethylphosphorothioic acid, desethylphoxim, and desethyl PO phoxim (13). Phoxim formed phoxim photoisomer (diethyloxyphosphoryl thioiminophenyl acetonitrile), TEPP, and *O,O,O,O*-tetraethylmonothiodiphosphate, on the cotton leaves and the glass plate by the irradiation (14).



phoxim carboxylic acid



phoxim photoisomer

Mocap. Methylene chloride extracts of bean and corn plants grown in soil treated with ^{14}C -Mocap (*O*-ethyl *S,S*-dipropyl phosphorodithioate) contained ethyl propyl sulfide, ethyl propyl sulfoxide, ethyl propyl sulfone, and propyl disulfide. The major water-soluble metabolite in plants was *O*-ethyl *S*-propyl phosphorothioic acid. One hundred days after treatment 1.91 and 1.53% of radioactivity were recovered from bean and corn plants, respectively. Only a small portion of radioactivity was taken up by plants. Most of the administered radioactivity remained in the soil, and in corn plants, it was unextractable (15).

When ethyl- ^{14}C -Mocap and propyl- ^{14}C -Mocap were administered orally (dose: 3.0×10^6 cpm⁶/rat), 50–57 and 65–66% of radioactivity were recovered from rat urine, respectively. *O*-Ethyl *S*-propyl phosphorothioic acid was established as the main metabolite. Other water-soluble metabolites were: *O*-ethyl phosphoric acid, *S*-propyl phosphorothioic acid, *S,S*-dipropyl phosphorodithioic acid. As chloroform-soluble metabolites, trace amounts of methyl propyl sulfide, methyl propyl sulfoxide, and methyl propyl sulfone were recovered. *In vitro* system of rat liver homogenate degraded Mocap to *O*-desethyl Mocap and *S*-ethyl glutathione (16).

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Appendix VIII: Terminal Residue of Fenitrothion

1. *In Mammals*. Fenitrothion, like many other organophosphorus compounds, was readily absorbed through the intestinal tract of animals. When ^{32}P -fenitrothion was administered orally to guinea pigs and white rats at the

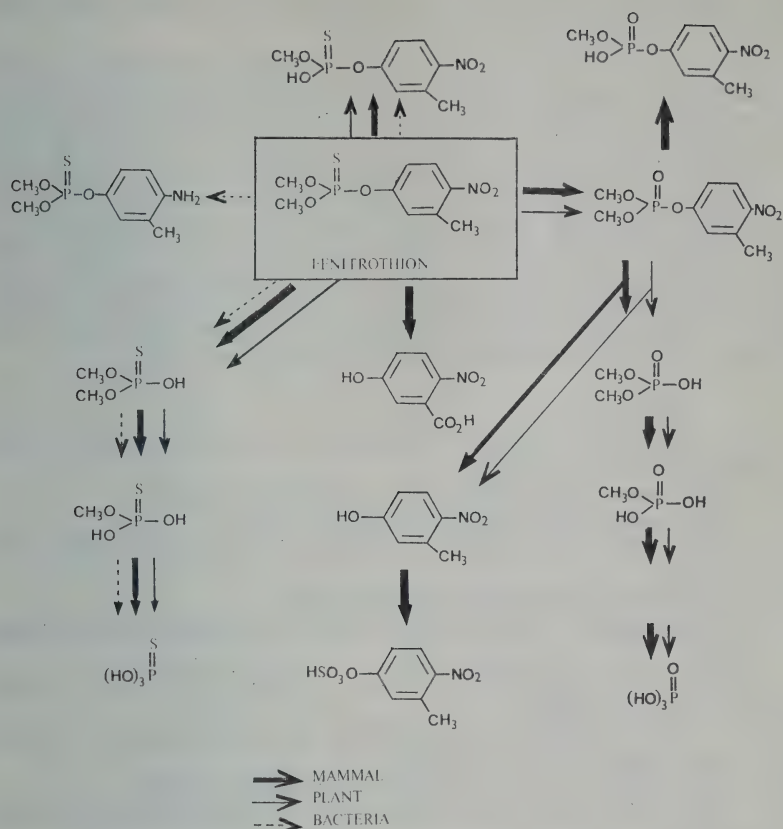
rate of 500 mg/kg and 15 mg/kg, respectively, the phosphorus content in blood reached its maximum 1–3 hours after administration and thereafter gradually decreased. A similar result was obtained with respect to the carbon-14 content in blood when ^{14}C -fenitrothion was administered orally to white rats at the rate of 15 mg/kg (2). While absorbed fenitrothion penetrated into various organs, it disappeared rather rapidly from these organs and its content in blood became less than 0.001 ppm some 4 days after oral administration to rats at the rate of 0.5 mg/kg (2,3). In the case of intravenous administration, the oxygen analogue of fenitrothion was detected in blood and tissues but rapidly disappeared with lapse of time (3,5). Fenitrothion was oxidized into its oxygen analogue by animal tissue enzymes *in vivo*, and it was proven that the oxygen analogue of fenitrothion was formed by rats, mice, and guinea pigs *in vitro* liver microsomal enzymes with NADpH (6). ^{32}P - and ^{14}C -fenitrothion administered orally were mainly excreted into urine. Most of the administered radioactivity was excreted into urine within 24 hours. Nearly complete excretion of radioactivity in urine was observed 72–96 hours after administration and the remaining radioactivity was excreted in faeces (1,2,7). These results were also supported by the following facts:

- (i) When rats were fed for 3 months with feed containing 250 ppm of fenitrothion, fenitrothion was not detected in their brain, fat, liver, and kidney (8).
- (ii) When cattle were fed for 7 days with pasture treated with fenitrothion, the fenitrothion content in fat and meat was 0.001 ppm or less (9).

In every case, neither fenitrothion nor its oxygen analogue was excreted in the urine (1,2,7). When metabolites derived from ^{32}P - or ^{14}C -fenitrothion were separated, identical compounds were observed commonly in rats, mice, guinea pigs, and rabbits, although the ratios of each metabolite were different. The compounds containing phosphorus-32 were mainly phosphoric acid, phosphorothioic acid, dimethyl phosphorothioic acid, and dimethyl phosphoric acid. Desmethyl fenitrothion desmethyl oxygen analogue of fenitrothion, *p*-nitroresol free and conjugated, *etc.*, were also observed. In rats, 5-hydroxy-2-nitrobenzoic acid was detected.

Many of these metabolites were present in liver and blood of rats and guinea pigs (3). It was proven *in vitro* that those were derived from fenitrothion by mammalian liver enzymes (6,11,12). In the case of humans, excretion of *p*-nitroresol into urine and faeces was nearly completed 24 hours after the administration of 2.5–20 mg/kg of fenitrothion, and 55–70% of the dose was recovered (13). The remainder was considered to be demethyl fenitrothion and other conjugates of metabolites. With respect to metabolites excreted in faeces of rats, 9% of fenitrothion (less than 1% of the dose), no oxygen analogue of fenitrothion, 70% of *p*-nitroresol, 13% of demethyl fenitrothion, and *ca.* 6% of desmethyl oxygen analogue of fenitrothion, and no compounds other than metabolites found in urine were detected (2).

2. *In Plants.* It was shown that when ^{32}P -fenitrothion was sprayed on young rice plants, it rapidly disappeared and produced a small quantity of the oxygen analogue of fenitrothion (1). Almost the same results were obtained as follows (14) when ^{32}P -fenitrothion was sprayed on rice plants at the heading stage.



When 0.05% of ^{32}P -fenitrothion was sprayed as an emulsified liquid on rice plants at the heading stage, about 12 ppm of fenitrothion attached to the plants and approximately half of the attached fenitrothion disappeared to the air 24 hours after application. The rest penetrated into the plant tissues and was decomposed to desmethyl fenitrothion, demethyl phosphorothioic acid, and dimethyl phosphoric acid after 1 week.

Just after application, a small quantity (<1 ppm) of the oxygen analogue of fenitrothion was detected in leaf and stem but decreased to 0.08–0.01 ppm after 1 week. Its degradation was more rapid than fenitrothion. In harvested rice grains, less than 0.001 ppm of fenitrothion was detected and the oxygen analogue of fenitrothion was detected.

When fenitrothion was sprayed on corn and Bermuda grass, similar results were obtained (15). Around 1% of fenitrothion which attached to the plants was converted to the oxygen analogue of fenitrothion, but its degradation was more rapid than fenitrothion and it reached at less than one tenth of the highest value 7–10 days after application. The content of *p*-nitroresol reached its maximum 1–7 days after application of fenitrothion and decreased a little more gradually than that of fenitrothion.

From the above, it was considered that the metabolic fate of fenitrothion

in plants was almost the same as in mammals and that the oxygen analogue of fenitrothion was not detected or, if it existed, was fairly less than fenitrothion under the usual application conditions.

(iii) *In Soil.* Fenitrothion decreased rather rapidly in soil and was easily absorbed from the ground water into the soil (half-value period: 5–7 days at room temperature) (16). Fenitrothion was decomposed by microorganisms such as *Pseudonas* and *Echerischia* in polluted water (17). When fenitrothion was added to a culture medium of *Bacillus subtilis*, most of the fenitrothion was converted to amino-fenitrothion and dimethyl phosphorothioic acid. Fenitrothion was easily reduced by resting cells of the bacterium. The oxygen analogue of fenitrothion and its metabolites were not detected. When fenitrothion was administered to milk cows, a small quantity of amino-fenitrothion (0.003 ppm) was detected (19). It was considered to be due to reduction of fenitrothion by microorganisms in rumen fluid (20). Amino-fenitrothion was presumed not to have biological activity (18).

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Appendix IX: Terminal Residues of Monocrotophos

The metabolic pattern of monocrotophos [phosphoric acid dimethylester, ester with 3-hydroxy-*N*-methylcrotonamide (E); dimethyl-*cis*-1-methyl-2-methylcarbamoyl-vinyl phosphate], as summarized in Fig. 1, was demon-

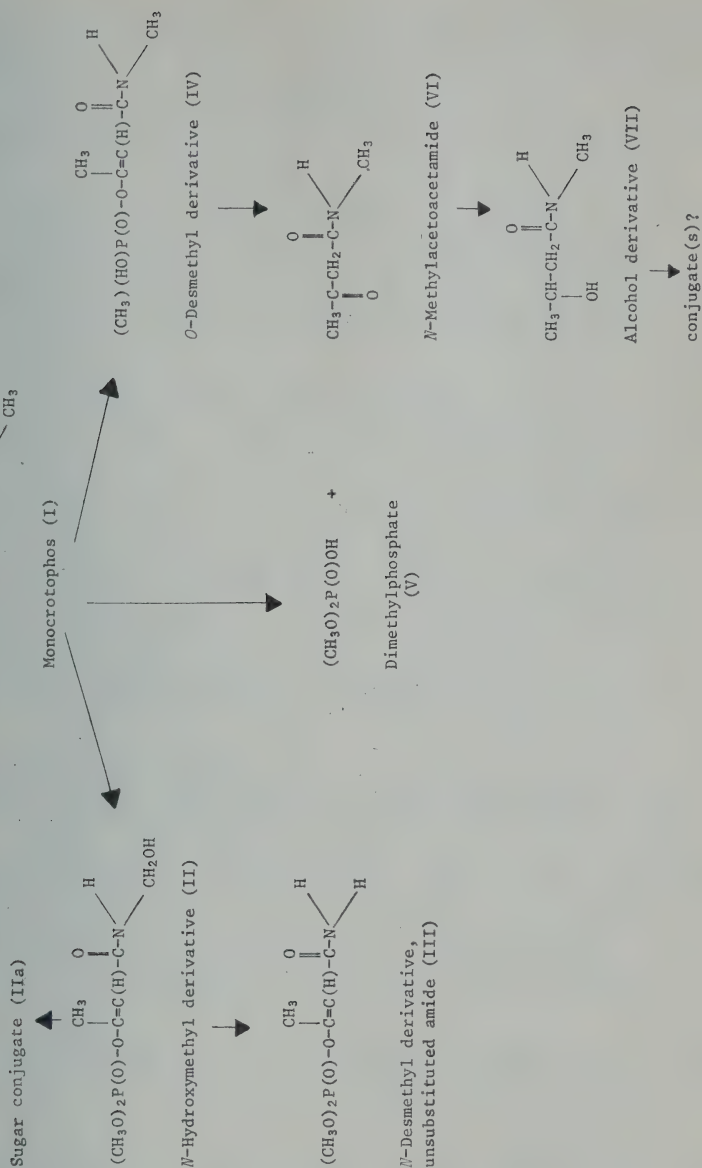


Fig. 1. Mammalian and plant metabolism of monocrotophos

strated to be essentially the same in both mammals and plants.

Mammalian metabolism experiments with ^{32}P - and/or (*N*-methyl) ^{14}C -labelled monocrotophos in rats (1,2), lactating cows (3), and goats (1), showed that the major portion of the administered insecticide was subjected

to hydrolytic degradation. Forty-eight hours after oral dosing of rats with ^{32}P -labelled monocrotophos, 12–13% of the ingested quantity was recovered in the urine unchanged, 48–52% as hydrolytic products (such as V) and only small quantities of the label represented metabolites II (0.6–1.6%) and III (0.2–0.3%) (1). In another study, urinary dimethyl phosphate (V) exceeded the formation of the *O*-desmethyl derivative (IV) by an approximate 4:1 ratio and only a trace of the unsubstituted amide was detected (2).

Trace amounts of the cholinesterase-inhibiting metabolites II and III were also detected in the milk of cows (3) and metabolite II was recovered from goat milk (1). However, the average residue levels of these organosoluble transformation products were exceedingly small (<0.002 ppm) and represented only a minute fraction of the relatively high quantities of monocrotophos administered (45 ppm in the total diet of cows fed continuously; 1 mg/kg single dose to goats). No residues of carbohydrate conjugates of the *N*-hydroxymethyl metabolite (IIa) were detected in cows milk (3).

Plant metabolism studies, first with ^{32}P - and then with ^{14}C - (*N*-methyl and *O*-methyl) labelled monocrotophos, were mainly conducted in the greenhouse and to a limited extent under field conditions (1,4,5). Applications comprised of treatment of foliage and fruit, seed dressing (not used in practice), petiole- and stem-injection. In these model experiments, in which the concentrations of monocrotophos applied were higher than those normally used in practice, the following metabolites were detected in addition to unchanged monocrotophos (I): the free and conjugated *N*-hydroxymethyl derivative (II, IIa), the unsubstituted amide (III), *O*-desmethyl monocrotophos (IV), and dimethyl phosphate (V). When using the *N*-methyl- ^{14}C -labelled insecticide, *N*-methylacetacetamide (VI) was observed to be a transient hydrolytic metabolite which was rapidly converted to its alcohol derivative (VII). Attempts to characterize the hydrophilic conjugates (IIa) of the *N*-hydroxymethyl metabolite (II) demonstrated that their chemical nature might differ from one plant species to another. However, they were shown to be mainly sugar derivatives (5).

Although residue levels of the cholinesterase-inhibiting metabolites II (free and conjugated) and III were consistently small in the above-described experiments, residue methods were devised to verify their presence or absence under field conditions (6,7). Results from trials with numerous crops, including sugar beet, potatoes, brussels sprouts, cauliflower, maize, pears, onions, soybean and cotton, demonstrated that residues of the above-mentioned oxidative metabolites were below detectable levels (8). Residues of neutral conjugates of the *N*-hydroxymethyl compound (II) in the range 0.05–0.35 ppm were found in only occasional samples of carrots, olives, and oranges (7).

In those crops and tissues, in which monocrotophos was found to be relatively slowly degraded (apples, citrus peel), terminal residues were demonstrated to consist only of the parent compound (8).

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Appendix X: Terminal Residues of Methidathion

The metabolism of methidathion [*O,O*-dimethyl-*S*-2-methoxy-1,3,4-thiadiazol-5(4H)-onyl-(4)-methyl-dithiophosphate] in mammals and plants was investigated with three different ^{14}C -labelled preparations ($^{14}\text{C}=\text{O}$; ring- O^{14}CH_3 ; $^{14}\text{CH}_2$). The scheme of degradation derived from these experiments was summarized in Fig. 1 (1,2,3).

In mammals the parent compound (I) was shown to be hydrolyzed whereby the sulfur atom remained on the heterocyclic moiety (analogous to chemical hydrolysis under alkaline conditions). The primary mercaptomethyl compound (in brackets), which was not detected as a metabolite, was then methylated (II). Oxidation led to the sulphoxide (III). This compound was mainly converted to carbon dioxide, a small portion being oxidized to the corresponding sulphone (IV). The latter metabolite was either excreted in the urine or also converted to carbon dioxide. With all three labelled preparations, expired ^{14}C -carbon dioxide was the main metabolite (up to 40% of the radioactivity applied). This indicated efficient breakdown of the heterocyclic moiety to C-1 fragments which then entered the endogenous carbon pool. The identified mammalian metabolites did not inhibit cholinesterase and their acute toxicity was demonstrated to be considerably lower than that of the parent insecticide. The toxic oxygen analogue (V) was not detected in mammalian tissues or excreta.

Feeding studies with ^{14}C -labelled methidathion in ruminants (2,5) demonstrated that the insecticide was extensively metabolized and excreted either as ^{14}C -carbon dioxide in the expired air or as polar metabolites in urine and faeces. Only about 1% of the applied label was recovered from milk as polar radioactivity. Small fractions of this radioactivity were present as the sulphoxide (III) and sulphone derivatives (IV), while the major portion of label apparently had been incorporated into natural milk constituents.

Plant metabolism experiments with ^{14}C -labelled methidathion were conducted in alfalfa (2,4), bean (2), and cotton (3). These studies demonstrated that a small amount of the insecticide was converted to the oxygen-analogue (V). Both the parent compound and the phosphate were hydrolyzed and a considerable portion of the heterocyclic moiety was shown to be degraded to C-1 fragments as indicated by the formation of labelled carbon dioxide. The organosoluble fraction derived from plants at different time intervals after application, contained the parent compound (I), a small amount of the oxygen-analogue (V), and a compound which was identified as the free heterocycle (VII). Of the radioactivity in the aqueous phase, four fractions were isolated. On acid hydrolysis the two main fractions liberated the free heterocycle (VII). These two fractions were, therefore, tentatively identified as conjugates (VI) with different plant constituent moieties. Although not shown in Fig. 1, some plant experiments indicated the forma-

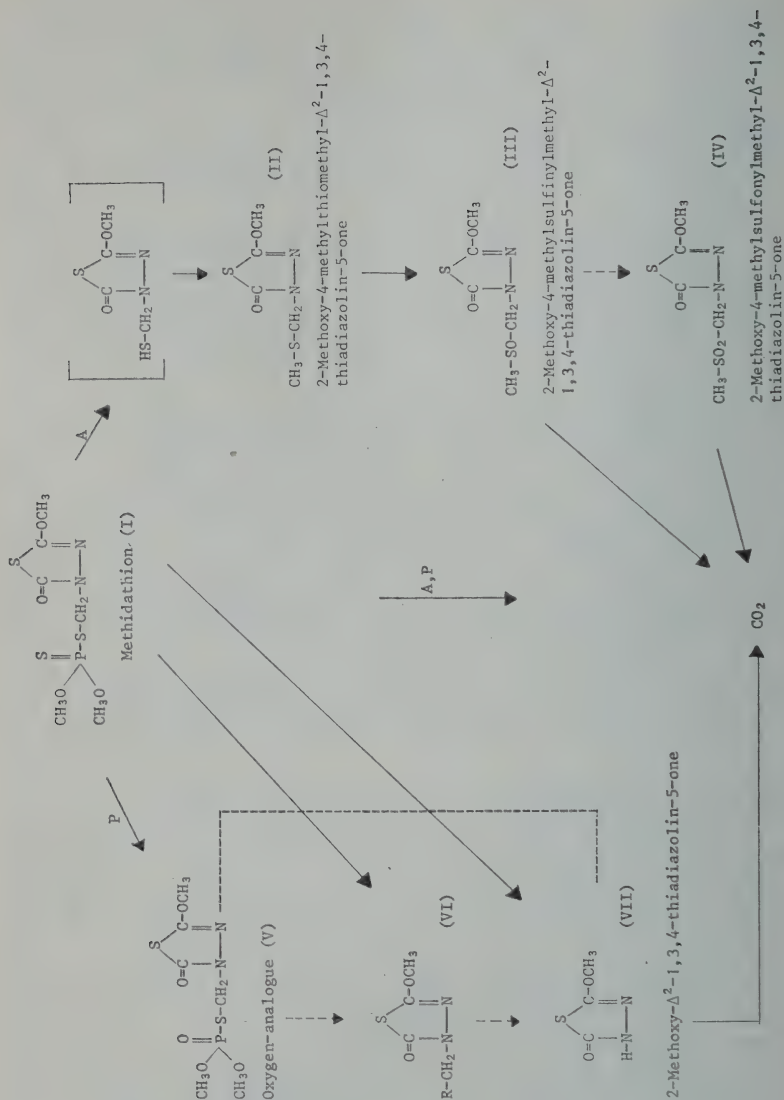


Fig. 1. Metabolism of methidathion in mammals and plants

(solid arrows represent degradation reactions leading to identified metabolites; dotted arrows indicate a minor pathway; dashed arrows represent unproven but reasonable pathways between identified metabolites)

tion of small quantities of the P-O-desmethyl-derivative of methidathion (2,3).

Based on the plant metabolite pattern described above, several residue methods were designed to account for methidathion itself and the transformation products (6,7). In numerous analyses of crop samples, only the parent compound and smaller amounts of the oxygen-analogue were detected (8).

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Appendix XI: Terminal Residues of Carbaryl

Numerous reviews to the general areas of carbamates (1-6) and specific references to the metabolic fate of carbaryl in biological media had been published recently. Quantitative differences in the extent of various metabolites had been noted. New terminal residues had been suggested in two instances, from cell culture and insect studies. However, these had not been confirmed.

In rats, it was observed that absorption of carbaryl probably occurred in the stomach or anterior portions of the small intestine (7,8). Carbaryl absorbed through the stomach was found to be unchanged in the blood (9). Carbaryl absorbed through the intestine underwent transformation to 1-naphthol and was conjugated as a glucuronide (10,11). In insects as well as mammals, it was observed that metabolism occurred during penetration from the gut (12,13). Studies on urinary metabolites in the rat had confirmed the identity of 5,6-dihydro-5,6-dihydroxycarbaryl glucuronide (14). Synthesis of the aglycone of this metabolite had been accomplished (15) and the identity of a urinary metabolite from cow urine and probably milk had also been reconfirmed from these studies. The fate of carbaryl in hens and eggs had been studied (16). After continuous dosing for 7 days, minor amounts of residues were observed in the carcass and eggs. In the egg 1-naphthyl sulfate was the predominant metabolite. Metabolic studies in several plant species confirmed the presence of *N*-hydroxymethyl carbaryl, 4- and 5-hydroxycarbaryl (17). Further studies on the metabolic fate of carbaryl in insects (18) had demonstrated that differing metabolism rates were probably responsible for differences in toxicity to two insect species. In the silkworm, a new metabolite, 2-hydroxycarbaryl, was isolated, characterized, and suggested as a metabolite (19). The presence of this product had not been confirmed in any other media.

In the cattle tick, carbaryl was degraded to α -naphthol, 1,5-naphthalene diol, and *N*-hydroxymethyl carbaryl (20). In soil in contrast to older studies, carbaryl was degraded very slowly (21). Studies using rice paddy soils from Japan indicated that metabolites similar to those found in plants were observed in soil extracts. The major product, α -naphthol, was further degraded to coumarin and three other products by soil microorganisms. Carbaryl was degraded by soil bacterium although metabolic products were

not identified (22,23). In culture media, when nitrogen was absent the organism apparently degraded at a much greater rate than when nitrogen was present (22). Where carbaryl was the sole source of carbon, metabolism was rapid and extensive (24).

Fungal transformation of carbaryl also resulted in *N*-alkyl and aromatic ring hydroxylation reactions prior to cleavage of the carbamate ester (25-29) and further degradation of the naphthyl moiety.

The instability of carbaryl in an aqueous environment was again demonstrated when it was observed that almost complete hydrolysis had occurred within 9 days at pH 8 (30). It was further observed that the *N*-methyl carbamates, carbaryl and propoxur, were relatively unstable when compared with the dimethyl esters, pyrolan and dimetilan. In farm pond water an *in vitro* study showed that carbaryl was degraded rapidly. Microorganisms were responsible for further breakdown and loss of α -naphthol (31).

Several studies had been reported on the biological interaction of carbaryl with endogenous materials. Pinolene, a β -pinene polymer, had been shown to extend the residual life of carbaryl on certain crops (32). Oral administration of gossypol was found to stimulate liver microsomal oxidative activity and concomitantly the ability to dealkylate carbaryl and other *N*-methyl and dimethyl carbamates (33). Similarly, methyl mercury and chlordane were observed to show the same increased effect on the metabolism of carbaryl and carbofuran (34). Compounds which were found to decrease MAO activity reduced the excretion of carbaryl from rats (35). Several studies on carbaryl metabolism had been reported using *in vitro* techniques, either cell culture, organ culture, or enzyme preparations (36-43). Using human lung cell cultures, rat liver and plant cell culture studies with carbaryl showed substantial metabolism to have occurred. Carbaryl was metabolized to hydroxylated products and conjugated (36,37). The report of a new metabolite, the N-O-conjugate of carbaryl (38, 39), remained open to question and possibly reflected *N*-hydroxymethyl carbaryl conjugates. An *in vitro* study using human and rat liver preparation indicated that human liver produced minor carbaryl metabolites not seen with rat tissue (40). These products were not identified. The major metabolites were common to both systems. A study with rat and mouse liver tissue incubated with carbaryl showed the presence of thioether amino acid (cysteine) conjugates of naphthalenediols (41). Carbaryl had been shown to be hydrolyzed to α -naphthol by human brain esterases (42). Further studies using a human *in vitro* liver tissue technique, developed a metabolic profile for carbaryl for comparison with metabolic data on experimental animals (43). Qualitative and quantitative differences were apparent between animal species, with no species giving a metabolic profile exactly like man, which confirmed the above-mentioned metabolic study (40).

Studies on the metabolism of *p*-chlorophenyl methyl carbamate in hens, rats, and goats had shown that the material was rapidly absorbed from the GI tract, hydrolyzed, conjugated, and excreted as a glucuronide or sulfate (44,45). In addition, goat urine and milk contained a sulfate conjugate of 4-chlorocatechol, indicating further metabolic breakdown not observed with the other species.

Aldicarb metabolism studies in hens indicated rapid excretion within 24 hours with extensive conversion (46). Metabolites in eggs were similar in chemical composition to those found in faeces. An organic-soluble fraction, constituting a major portion of residues in the yolk, needed further clarification. In cotton seed and foliage following soil application, aldicarb

was degraded to previously identified products, aldicarb sulfoxide, sulfone, and water-soluble noncarbamate esters (47).

The metabolism of carbofuran in tobacco (48) followed a pattern previously described in the literature (6); oxidation and conjugation to yield 3-hydroxycarbofuran, 3-ketocarbofuran, hydrolysis (or oxidative cleavage) to the respective phenols and conjugation as glycosides. In the earthworm (*Lumbricus ferrestris*) carbofuran metabolism appeared to follow the same pattern of oxidation with the carbamate excreted in an unconjugated form (49). The lack of conjugation in this species was intriguing, because this resulted in continued exposure of the toxicant even after excretion. A metabolite not extensively mentioned in the literature but which had been suggested on several occasions, was the *N*-hydroxymethyl-3-hydroxycarbofuran (51–54). The product had been reported predominantly by one research team and required confirmation.

The metabolism of Bux in soil followed the typical pattern observed with other carbamates (50). The majority of the molecule was cleaved at the ester bond with small quantities of unstable oxidative products formed. Although only the *m*-(1-hydroxy-1-methylbutyl)phenyl methyl carbamate was identified, the presence of the *m*-(1-hydroxy-1-ethylpropyl)phenyl methyl carbamate might be expected.

Matacil (4-dimethylamino, 3-cresyl methyl carbamate) was degraded by human and rat liver preparations (40). Several methyl carbamate metabolites were identified; 4-amino-3-cresyl, 4-methylamino, 3-cresyl, and the *N*-hydroxymethyl derivative. Degradation of Zectran (4-dimethylamino, 3,5-xylyl methyl carbamate) by these systems again resulted in a similar metabolic pattern with one human preparation producing several small products not observed with the rat. Similarities were noted in the production of the following methyl carbamates: 4-aminomethyl 3,5-xylyl, 4-amino 3,5-xylyl and 4-methylformamido 3,5-xylyl. The *N*-methylol derivative of Zectran was also identified. A major metabolite of Mesurool (4-thiomethyl, 3,5-xylyl methyl carbamate) was identified as the sulfoxide (4-methylsulfinyl 3,5-xylyl methyl carbamate). Ring oxidation of Banol (3,4-xylyl, 6-chloro methyl carbamate) to yield a benzoic acid, methyl carbamate derivative had been postulated from these *in vitro* studies (40). The presence of this product had not been verified.

The metabolism of *m*-*tert*-butylphenyl methyl carbamate in mice and insects was observed to be oxidative with hydroxylation occurring on the *N*-methyl and *tert*-butyl moieties (55). Oxidative cleavage of the carbamate ester was also a major reaction resulting in conjugated phenols.

Spontaneous hydrolytic and oxidative degradation of *N*-(4-methylcarbamoyloxy-*o*-tolyl)*N,N*-dimethylformamide (UC 34096) was observed to occur in cell culture media (37). In water, further decomposition was observed with the formation of 4-(methylcarbamoyloxy)-*N*-formyl-*o*-toluidine, 4-hydroxy-*N*-formyl-toluidine, and 4-(methylcarbamoyloxy)-*o*-toluidine.

Meobal (3,4-dimethylphenyl methyl carbamate) was metabolized in the rat to the methyl carbamates of 3-hydroxymethyl, 4-methylphenol, 4-carboxy, 3-methylphenol, and the hydroxymethyl carbamate of 4-carboxy-3-methylphenol as well as the free and conjugated phenols (56).

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Appendix XII: Terminal Residues of Fumigants

This report contained accounts of work published since the 1971 Meeting or known to be in progress, which had a particular bearing on the nature and magnitude of terminal residues of or produced by fumigants. It might usefully be read in conjunction with the 1973 Report on Fumigants to the Commission on Pesticide Residue Analysis (see page 321), which recorded work germane to the validity of some of the conclusions reported here.

Validity of Results of Analyses. During 1971 MALONE (1) published a comprehensive review of analytical methods for fumigant residues, which *inter alia* discussed the nature of the residues determined and laid particular emphasis on the need to avoid artefacts produced by the method of analysis. This aspect of the reporting of terminal residues had also been emphasized by HEUSER (2, 3). Thus MCMAHON (née MALONE) (4, 5) reported the occurrence of chloroform residues in grain fumigated with carbon tetrachloride when analysed by a method involving acid reflux, followed by steam distillation

and gas chromatography. SCUDAMORE and HEUSER (6) later showed that steam distillation in the presence of grain induced the breakdown of carbon tetrachloride to chloroform, because none of the latter was found when a cold extraction method, known to be effective in the recovery of chloroform, was used to determine organic residues in the same carbon tetrachloride-fumigated grain. In a somewhat different context, the validity of past residue work with both normal and radioactive phosphine had been confirmed in work described below.

Residues from Phosphine. Much effort had gone into work designed to show that residue studies using ^{32}P -labelled phosphine were capable of yielding data valid for nonradioactive phosphine, following doubts expressed by RAUSCHER (7). It was suggested that radiation self-decomposition could cause a chemical change in the phosphine molecule or alternatively that isotope exchange might occur between ^{32}P in the fumigant and ^{31}P in the fumigated substrate, thus giving a spurious indication by radiometric counting of a residue where no molecular transfer had, in fact, taken place.

DISNEY and FOWLER (8, 9) had described experiments in which the loss due to sorption of normal and radioactive phosphine from the free space above cereal products was found to be strictly comparable, and additionally they found no unexpected change in the specific activity of the labelled phosphine on exposure to grain, as would be measured had isotope exchange taken place. DISNEY and FOWLER therefore concluded that at the very low concentration levels (*ca.* 1–5 mg/l.) used in their experiments, the ^{32}P -labelled fumigant behaved in all respects as the normal compound.

ROBINSON (10), using normal phosphine, determined phosphorus-bearing residues produced in an inert phosphorus-free substrate (washed cellulose) by measuring radioactivity following neutron activation of the residue. He postulated that if an inert material could give rise to phosphorus-containing residues when exposed to phosphine, there was no reason why cereal products should not behave similarly.

DISNEY and FOWLER (8, 9) found that the amount of phosphorus-containing residue produced in wheat on exposure to phosphine increased with time, with temperature, and with increased moisture content. Most of the residue was found in the outer layers and in the 'crease' of whole wheat grains. Milled fractions fumigated individually with phosphine at 2.4 mg/l for 14 days at 25°C showed the bran to be most reactive (22 ppm calculated as PH_3), followed by fine offal (10 ppm), with flour showing residues of only about 5% of those figures. When samples of the thoroughly aired flour were baked, no loss of residue was experienced, the residue remaining evenly distributed throughout the loaf. Some 70–75% of the phosphorus-containing residue from wheat was extractable with cold water. Their findings were consistent with those of TKACHUK (11) and the earlier work of ROBINSON and BOND (12), which showed that the water-soluble fraction consisted largely of oxyacids of phosphorus, *e.g.*, orthophosphate, pyrophosphate, and hypophosphite. At currently used commercial dosage levels, such residues would be unlikely to exceed 5 ppm overall.

TKACHUK (11), using gel permeation chromatography, found that protein in ^{32}P -phosphine fumigated bovine haemoglobin became labelled with phosphorus-32, whereas in fumigated wheat the radioactive fraction was eluted separately from the wheat protein fraction.

Residues from Bromine-containing Fumigants. DUMAS (13) investigated the effect of temperature of fumigation on residues produced in apples, cherries,

peaches, plums, and walnuts, when treated with methyl bromide or ethylene dibromide. He found that with methyl bromide the amounts of inorganic bromide produced were decreased with lower temperature, even when the dose of fumigant used was increased in compensation. Bromide residue found in peaches fumigated for 2 hours at atmospheric pressure was highest in the skin and seed and lowest in the pulp. No free methyl bromide could be detected 1 hour after treatment in apples fumigated for 2 hours at 40 mg/l. at 25°.

Approximately 0.2 ppm of free ethylene dibromide (EDB) could be found in apples fumigated at 12 mg/l. for 4 hours at 13°C and stored at this temperature, 12 days after treatment, but none was found after 5 days when they were stored at 25°C.

SEO *et al.* (14) determined free EDB and inorganic bromide in mangoes after an integrated treatment consisting of heating in water for 20 minutes at 46°C followed by fumigation at 8–12 mg/l. with EDB for 2 hours at 21°C and subsequent storage under refrigeration at 7.6°C for 4 days. However, 1 day after removal from refrigeration the fruit contained about 3 ppm of EDB, reducing to 0.14–0.4 ppm after 3 days. Inorganic bromide levels produced by the treatment were 2–3 ppm and no injury to the fruit resulted.

SCUDAMORE (15) determined free methyl bromide in pelleted chicken-feed commercially fumigated with methyl bromide at a c.t. product of 320 mg. h.l. over 24 hours. Immediately after fumigation samples contained 67–84 ppm of free methyl bromide, but levels fell to less than 0.5 ppm within 24 hours at ambient temperatures. The same worker also determined inorganic bromide produced in dried egg powder as a result of exposure to methyl bromide at c.t. products of 200 and 400 mg.h.l. over 24 hours at 25°C, finding 430 ppm and 810 ppm, respectively.

DENNIS *et al.* (16) reported finding increasing amounts of methyl chloride in the head space during methyl bromide fumigation of wheat and maize, presumably as a reaction product. Because methyl chloride was even more volatile than methyl bromide, it seemed unlikely to occur in measurable quantities as a residue.

Residues from Other Fumigants. BERCK (17) determined carbon tetrachloride and ethylene dibromide residues in wheat fumigated by surface spraying with Dow EB5, a CT/EDC/EDB 60:30:7 w/w mixture in a 1000 bushel bin (16 feet in diameter, 6 ft high). He was unable to determine ethylene dichloride residues due to lack of method sensitivity. In sampling periods of up to 7 weeks after treatment, amounts of carbon tetrachloride found ranged from 3 to 54 ppm and of ethylene dibromide from nil to 3.3 ppm. In milled fractions of the wheat, carbon tetrachloride residues ranged from 0.0002 to 0.0009 ppm in flour, 0.0003 to 0.003 ppm in bran, and 0.0002 to 0.0016 ppm in middlings. Corresponding figures for EDB did not exceed 0.00003 ppm in any of the fractions. In bread baked from this flour, carbon tetrachloride found ranged from nil to 0.00004 ppm whilst no EDB was detected.

After controlled laboratory exposures of wheat and maize to carbon tetrachloride (CT) at c.t. products of 6000 and 12000 at 10°C or 25°C, *i.e.*, within the range necessary for insect control, SCUDAMORE and HEUSER (6) determined the rate of loss of fumigant residue on airing over periods of up to 1 year. Initial residues of 240–280 ppm in wheat and 320–460 ppm in maize fell to between 9 and 60 ppm in wheat after 1 month and to between 30 and 170 ppm in maize, with the higher level of residue remaining in both cereals when aired at 10°C as opposed to 25°C. After 1 year, levels ranged from

0.1 ppm to 11 ppm, the highest residue being found in maize aired at 10°C. On milling, residues were approximately halved immediately but fell to 2 ppm or less within 1 month and to 0.03–0.3 ppm within 6 months. As an interesting sidelight to these investigations, SCUDAMORE (15) later found that in individual maize grains uniformly fumigated, residues varied from 2 to 97 ppm.

STOREY *et al.* (18) reported on the fate of CT: EDC residues in fumigated soya beans during milling and oil extraction. It appeared that toasting removed the residue from the hulls, whilst hexane extraction of the oil and meal fractions removed the residual fumigants. This could ultimately constitute a hazard in the hexane, which was continuously recycled.

STIJVE and CARDINALE (19) reported the formation of considerable amounts (200–700 ppm) of 2-acetoxyethanol (ethylene glycol monoacetate) in cocoa beans and powder when fumigated with ethylene oxide, due to its reaction with acetic acid in the commodities. These residues did not appear to decrease with time.

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Appendix XIII: Terminal Residues of Ethylenethiourea

Ethylenethiourea (ETU) (2-imidazolinethione) was a degradation product of the ethylene bisdithiocarbamate fungicides, nabam, zineb, polyram, maneb, and Dithane M-45. It had been detected in formulated materials and as residues in certain food crops. Toxicological investigations had demonstrated

that at high concentrations ETU was both a carcinogenic and goitrogenic compound.

Residues

(i) *In Plants*. Thin layer and gas chromatographic methods had been developed for the determination of ETU in fruits, vegetables, and milk by ONLEY and YIP (1). Residues of ETU were detected on lettuce and kale treated with a nabam formulation applied at a rate of 2.5 pounds active per acre [YIP *et al.* (2)]. With both crops, ETU did not accumulate on the leaf surfaces, but quickly decreased from 0.6 ppm to undetectable amounts after 7 days. BLAZQUEZ (3) had developed a TLC method which had a sensitivity of 1 ppm for ETU. No ETU residues were detected on tomato foliage sprayed with Dithane M-45.

(ii) *In Soils*. ETU applied to soil was degraded rapidly. KAUFMAN and FLETCHER (4) found that all the ETU was dissipated within 2 days in soils treated with 2 and 20 ppm of ETU and within 8 days in soils receiving 200 ppm. A slower, but steady conversion of ETU occurred in autoclaved soil. Essentially no ^{14}C -carbon dioxide was evolved from autoclaved soils treated with ^{14}C -ETU. BLAZQUEZ (3) could detect no residues of ETU from soils treated with Dithane M-45 using TLC. ETU was inherently mobile and weakly adsorbed in soils; however, when soils were dried before or during leaching, ETU became irreversibly adsorbed or degraded to an immobile product [HELLING and THOMPSON (5)]. 2-Imidazolidone (EU) and sulfur were postulated degradation products.

Conversion Products

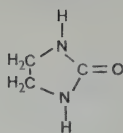
(i) *In Plants*. VONK and KAARS SIJPESTEIJN (6) reported the appearance of 2-imidazoline as a minor conversion product of ETU in seedlings of cucumber and wheat. The mechanism of conversion of ETU to 2-imidazoline was obscure, but it was apparently catalyzed by monoenzymatic reactions involving plant constituents.



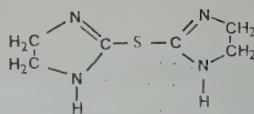
(ii) *In Soils*. KAUFMAN and FLETCHER (4) reported that ETU was rapidly converted to 2-imidazolidone (EU). Four additional ETU degradation products were isolated and characterized. Two of these products were identified as 2,4-imidazolidinedione (hydantoin) and 1-(2-imidazolin-2-yl)-2-imidazolinethione.

Photoproducts

Ultraviolet radiation of ETU afforded 2-imidazolidone as a major photoproduct (7). The 2-imidazolidone did not appear to undergo further degradation via photolysis. Aqueous solutions of the ETU underwent a slow photolysis unless photosynthetizers were added. Several photoproducts were formed, but only the bis(imidazolin-2-yl) sulfide could be identified. ROSS and CROSBY (8) also reported that ETU was stable to sunlight in aqueous solutions. In the presence of dissolved oxygen or sensitizers, ETU was rapidly photooxidized to ethyleneurea (EU) and glycine sulfate.



2-Imidazolidone



Bis(imidazolin-2-yl) sulfide

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Appendix XIV: Terminal Residues of Organotin Compounds

Two papers on the persistence and degradation of organotin compounds had been noted. BARNES *et al.* (1) described a study of the persistence of fentin acetate in soil. The fungicide was degraded biologically, 50% being decomposed in 140 days. The photochemical degradation of fentin acetate into inorganic tin via diphenyltin and monophenyltin was also demonstrated and the leaching of fentin acetate in soil and its effect on soil nitrification were also discussed. CHAPMAN and PRICE (2) studied the degradation of fentin acetate and hydroxide under irradiation with ultraviolet light. The FAO-WHO Monographs (3) on fentins and tricyclohexyltin hydroxide were also relevant.

LUIJTEN (4) had compiled a bibliography of organotin analysis. GETZENDAMER and CORBIN (5) described a colorimetric procedure for determining residues of total tin and organic tin resulting from the use of tricyclohexyltin hydroxide on apples and pears. Most of the total tin remaining 4 weeks after spraying was present as parent tricyclohexyltin hydroxide, nearly all being on the peel of the fruit. TROMBETTI *et al.* (6) studied the influence of tricyclohexyltin hydroxide on fermentation and determined residues in musts and wines.

There was a growing tendency to try methods other than colorimetric for the determination of residues of organotin compounds. BOOTH *et al.* (7) had applied a fully automatic apparatus for stripping voltammetry to the determination of submicrogram amounts of fentin acetate and hydroxide. The use of selective detectors for GLC of tin compounds was also being advocated by several authors [AUE and HILL (8); DRESSLER *et al.* (9); BRAZHNIKOV and SAKODYNSKY (10)].

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Appendix XV: Terminal Residues of TCDD

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) was a contaminant found in some samples of the herbicide 2,4,5-T. The discovery that TCDD was a powerful teratogen led to a partial ban on certain uses of 2,4,5-T in USA. Agent Orange, used as a defoliant in Vietnam, contained both 2,4-D and 2,4,5-T and trace amounts of TCDD. The detection of TCDD in fish in Vietnam had further deepened the controversy surrounding 2,4,5-T.

Residues

(i) *In Animals*. A single oral dose of 50 µg/kg of ¹⁴C-TCDD was administered to male rats and the tissue distribution and excretory rates were studied over 21 days. The major excretory route for radioactivity was the faeces, the mean amount recovered after 21 days in the faeces of three rats was 53.4%, the urine 13.4%, and expired air 3.2% (1). The liver content of carbon-14 declined from 45% at 7 days to 11% at 21 days. TCDD was the most toxic, acnegenic, embryotoxic, and positive for chick edema factor when compared to the di-, hexa-, and octachlorodioxin (2). The no effect dose levels for embryotoxicity and chick edema were 0.03 and 0.1 µg/kg/day.

(ii) *In Soils*. The persistence of TCDD was determined in Hagerstown silty clay loam and Lakeland loamy sand receiving 1, 10, or 100 ppm of TCDD after 20, 40, 80, 160, and 350 days (3). After 1 year, 56 and 63% of the originally applied TCDD was recovered in the Hagerstown and Lakeland soils, respectively. Soil samples taken from a Lakeland sand in Florida were analyzed for TCDD after applications of up to a total of 912 lb of 2,4,5-T/acre (4). No TCDD was detected at a minimum detection limit of ppb in core samples to a depth of 3 feet. Small amounts of 2,4,5-T were found at all depths.

(iii) *In Plants*. The uptake of ¹⁴C-TCDD from Lakeland sandy loam soil by oats and soybeans was measured by ISENSEE and JONES (5). From soil containing 0.06 ppm of ¹⁴C-TCDD, small amounts of carbon-14 were detected

(ca. 50 ppb) in seedling oats. At maturity, oat seeds and soybean tops contained <1 ppb of TCDD. It was important to recognize that the rates used in these studies were many thousand times greater than those residues encountered under actual field conditions.

At the present time a national TCDD monitoring survey was in progress in USA, using the great sensitivity afforded by the double focusing mass spectrometer equipped with a time averaging computer. The effective range of detection of TCDD was from 10 to 1000 ng/kg after careful cleanup.

Transformations

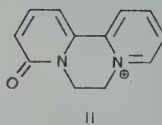
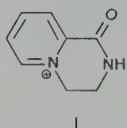
Photodecomposition. The chlorinated dioxins were degraded, when dissolved in methanol, by irradiation in sunlight and by UV sources under laboratory conditions (6). TCDD was dechlorinated in methanol and the 2,3,7-trichlorodibenzo-*p*-dioxin was identified by gas chromatography and mass spectrometry as a photoproduct. Smaller amounts of the dichloro analogue were also detected. In contrast, TCDD was not degraded on soil surfaces when applied at 0.1 $\mu\text{g}/\text{cm}^2$ to a 250- μm layer of either wet or dry Norfolk sandy loam or Hagerstown silty clay loam and irradiated for 96 hours. Quantitative recovery of TCDD showed that there was no loss due to volatility or photodecomposition. UV irradiation of an aqueous suspension of TCDD dispersed and stabilized by a surfactant was effective in reducing concentration. The environmental significance of TCDD photolysis in water was still obscure.

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Appendix XVI: Terminal Residues of Diquat in Plants

FUNDERBURK and LAWRENCE (1) had demonstrated that ^{14}C -diquat, like the related herbicide paraquat, was not metabolized in alligator weed following root uptake from nutrient solution. SLADE and SMITH (2) showed that, although the compound was not metabolized in plants, photochemical degradation of diquat occurred on the surface of leaves, but difficulties of separating the water-soluble degradation products from naturally occurring materials meant that their nature had not yet been finally resolved. The



1,2,3,4-tetrahydro-1-oxopyrido[1,2-*a*]-5-pyrazinium ion (I) was certainly produced and had been measured by a polarographic analytical method by YUEN (3) following field applications of diquat. The monopyridone of diquat (II) was possibly present in small quantities.

When diquat adsorbed on cellulose was exposed to sunlight, a complex product was formed (4) which possibly involved a photochemical reaction between diquat, or one of its breakdown products, with cellulose. This "photoproduct" had not been identified: it might also be present on diquat-treated plant material exposed to sunlight. SMITH (5), by treating potato haulm with ^{14}C -diquat and subsequently showing that all the radioactivity in the tubers could be accounted for as diquat, had demonstrated that, as in the case of paraquat, the photochemical degradation products of diquat were not translocated from the herbicide-damaged tissue on which they were formed.

As would be expected from the differences in UV absorption spectra of the two compounds, diquat was degraded photochemically on plants in sunlight much more rapidly than paraquat. In June in UK, a loss of more than 75% of diquat sprayed on grass was observed in 4 days (6). When barley straw desiccated at field rates with ^{14}C -diquat was fed to goats, virtually all the radioactivity, largely present in breakdown products, was eliminated from the goats within 10 days, mainly in the faeces. A trace of radioactivity appeared in the milk, mainly due to incorporation into lactose, fats, and protein (7).

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Appendix XVIIa: Terminal Residues of Chlordimeform

Chlordimeform [N^1 -(4-chloro-*o*-tolyl)- N,N -dimethylformamidine] was a novel type of acaricide-insecticide used in plant protection and animal hygiene. Although its pathways of transformation were basically the same in plants and animals, the mammalian organism appeared to be more versatile in altering the compound than plant tissues. The metabolic pattern of chlordimeform was summarized in Fig. 1.

When evaluating the metabolism and terminal residue data described below, it had to be remembered that chlordimeform (I) was readily hydrolyzed in weakly acid to weakly alkaline solutions. In an aqueous buffer solution of pH 7 containing 5% methanol, the acaricide showed a half-life of 42 hours at 30°C. At pH 9, under otherwise equivalent conditions, a half-life of 5 hours was observed. Hydrolysis of the parent compound yielded 4-chloro-*o*-formotoluidide (III) and ultimately 4-chloro-*o*-toluidine (IV). However, the second step of the hydrolysis was very slow at room temperature and it was only accelerated by heating with strong acids or alkali (1). Formation of 4-chloro-*o*-formotoluidide (III) and trace amounts of 4-chloro-*o*-toluidine (IV) under biological conditions was therefore considered to be a chemical and not an enzymatic process.

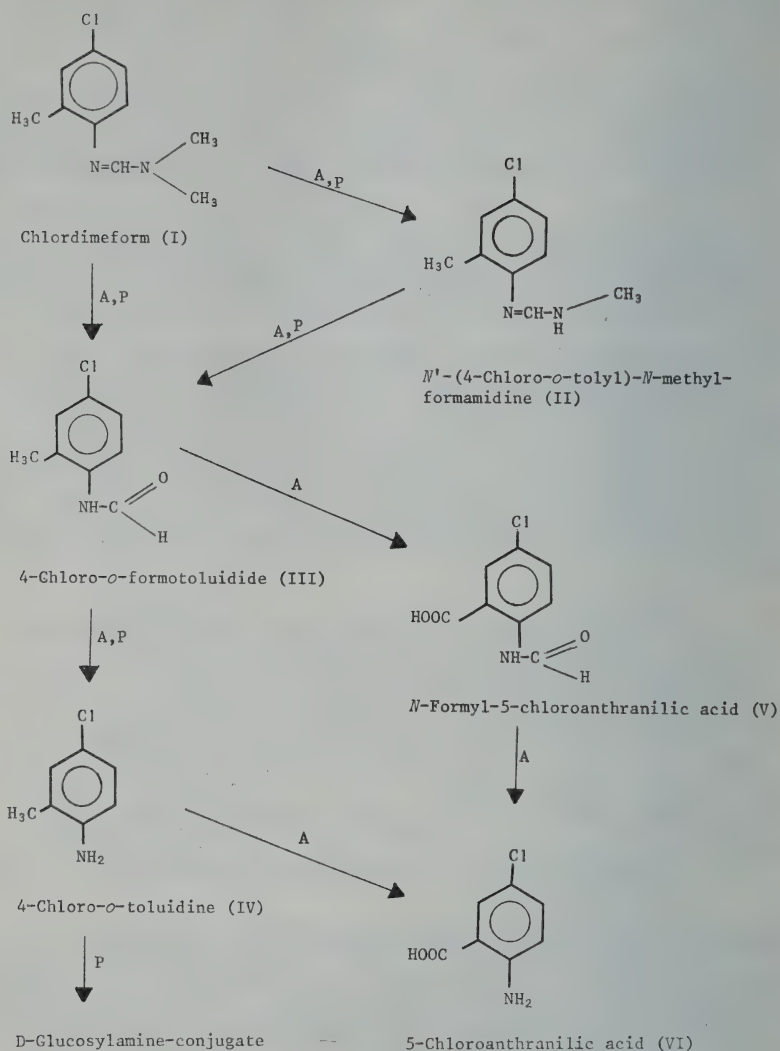


Fig. 1. Pathways of transformation of chlordimeform in animals (A) and plants (P).

Mammalian metabolism was investigated with ^3H - and ^{14}C -(tolyl-) labelled chlordimeform in rats (2,3), dogs (4,5), and goats (4,5). There were differences in the rates of transformation of the acaricide by the three mentioned species, the rat apparently being less efficient in degradation than either the dog or the goat. Organosoluble metabolites extracted from rat, dog, and goat urine included compounds I-VI as shown in Fig. 1. The nature of water-soluble metabolites in dog and goat urine was determined by

incubating the aqueous fraction with β -glucuronidase/aryl sulfatase preparations. Aglycones were observed to correspond to the organosoluble compounds I-VI and, in addition, included several minor unidentified metabolites. There was no appreciable storage of labelled material in dog and rat tissues or elimination in goat milk.

Several residue experiments were conducted with cattle which had been exposed to dipping solutions of chlordimeform (6). In these experiments the total residue (including all 4-chloro-*o*-toluidine-containing metabolites and/or conjugates) in tissues was shown to be no more and usually much less than 0.5 ppm. Residues in milk derived from treated cows were below 0.05 ppm, and butter prepared from such milk showed total residues of less than 0.5 ppm. In a preliminary investigation the residues in butter were found to consist of the parent compound and metabolites III and IV. No additional experiments were planned because the manufacturer expected to replace chlordimeform by a new ectoparasiticide.

The plant metabolism was investigated with ^3H - and ^{14}C -(tolyl)-labelled chlordimeform on apple and grapefruit seedlings under greenhouse conditions (7,8). Degradation in actively growing tissues was shown to proceed via *N*-desmethylation to metabolite II and/or by direct hydrolysis to the formyl-derivative (III). Further hydrolysis to 4-chloro-*o*-toluidine (IV) proceeded rather slowly. This latter metabolite was observed to be conjugated and the conjugate was tentatively identified to be a β -glucosylamine. No oxidation of the tolyl-moiety was observed in plant tissues.

Numerous analyses carried out on field grown crops demonstrated that terminal residues consisted of the parent compound and smaller amounts of 4-chloro-*o*-formotoluidide (III) (9,10). Traces of 4-chloro-*o*-toluidine were occasionally observed on some crops; however, formation of this compound as an artefact during extraction and cleanup could not always be excluded.

In certain model experiments it was reported that 4-chloro-*o*-toluidine, a potential metabolite of chlordimeform, could form the corresponding azo- or azoxybenzene derivatives (11,12). However, a number of analyses had demonstrated that under practical application conditions no such derivatives were formed in either animal or plant tissues (9).

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Appendix XVIIb: Terminal Residues of Chlordimeform

Chlorodimeform had been found to be useful for controlling rice stem borers in Japan. There had been numerous reports on the metabolism of chlorodimeform in animals and plants. However, little study on its comparative toxicology between mammals and insects had been done. The biodegradation of chlorodimeform in rat was investigated both *in vivo* and *in vitro* using ^{14}C -chlorodimeform. TLC, IR, and mass spectra showed its metabolites as (I)-(IV) and the sequence studies suggested the metabolic pathways of chlorodimeform as shown in Fig. 1 in Appendix XVIIa (see page 300). For rice stem borer, TLC showed that the major metabolites were found to be identical with those obtained in rat also *in vivo* and *in vitro* (FUKAMI *et al.*, 1973). The reasons of selective toxicities of chlorodimeform seemed to be probable that the rate of its excretion in rat (by analysis of urine and faeces) was much faster than that of rice stem borer, and the enzyme activity for chlorodimeform to DM in rat liver microsome was much higher than that of the whole homogenate of rice stem borer.

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COMMISSION ON PESTICIDE RESIDUE ANALYSIS (VI.5.2)

25 August 1973

Present: Dr. D. C. ABBOTT (Chairman), Dr. P. SLADE (Secretary), Dr. H. FREHSE, Prof. P. E. KOVISTOINEN, Dr. P. B. POLEN, Dr. CH. RESNICK (Titular Members); Dr. V. BÁTORA, Mr. K. E. ELGAR, Dr. S. GORBACH (Associate Members); Dr. R. L. BARON, Dr. W. B. COCHRANE, Dr. N. DRESCHER, Dr. K. FUKUNAGA, Dr. H. GEISSBÜHLER, Dr. P. GREVE, Mr. S. G. HEUSER, Dr. K. R. HILL, Dr. H. HURTIG, Dr. P. E. PORTER, Dr. ROLEDER, Dr. E. E. TURTLE, Dr. G. VETTORAZZI, Dr. S. L. VITOROVIČ (Observers).

1. Minutes of Previous Meeting

The minutes of the Sixth Meeting of the Commission, held in Washington, DC, on 18–19 July 1971, had been published, together with Appendices, in *Comptes Rendus XXVI Conference* (see pages 247–251).

2. Matters Arising from Minutes

- (i) A summary of the proceedings of the 1971 Meeting would be published in *J. Assoc. Offic. Anal. Chem.*
- (ii) Dr. ABBOTT reported that he had sent comments on the methods received by the Commission from CEE [Item 4(iii)].
- (iii) The OECD work [Item 4(iv)] had been published in part in *Pestic. Monit. J.* **4**, 117 (1970).
- (iv) A request had been received from the Oils and Fats Section for assistance in a collaborative study on the analysis of organochlorine residues in oils and fats [Item 5(ii)]. This had been discussed at the joint meeting in Munich between the two Sections.
- (v) Work referred to in Item 6(ii) had now been published [*Analyst* **98**, 19 (1973)].
- (vi) It was noted that several groups were involved in collaborative studies of mercury analysis [Item 7(ii)].
- (vii) The book on mercury [Item 7(iii)], sponsored jointly by WHO-FAO-IAEA, had been published as Technical Report Series No. 137 (1972). A second more up-to-date version was also now available.

3. Membership

Dr. H. FREHSE was nominated as Chairman of the Commission. Dr. K. R. HILL and Dr. V. BÁTORA (previously an Associate Member) were nominated as Titular Members. The term of Titular Membership of Dr. CH. RESNICK had expired, and he was nominated as an Associate Member. Mr. W. BURNS BROWN had resigned as an Associate Member and Mr. S. G. HEUSER and Dr. W. A. AUE were nominated as additional Associate Members.

4. International Liaison

- (i) *FAO*. It was agreed that it would be useful if selected residue analysts from developing countries could attend future Commission meetings as Observers.
- (ii) *Codex Committee on Pesticide Residues*. Dr. FREHSE introduced a report which he had prepared after attending the 6th Session of the Codex Com-

mittee on Pesticide Residues. The Committee still seemed to favour the recommendation of a definite residue analytical method for each pesticide. Members discussed this matter, and the clear view emerged that such a recommendation could not be made (see Item 6).

Dr. SLADE had prepared a paper on analysis of rethrans and synergists which had been requested by Codex, and this would be submitted. Comments by Members on methods received from Codex had been assembled by Dr. ABBOTT and a report submitted.

(iii) *FAO-IAEA*. Dr. WINTERINGHAM had submitted a report on the FAO-IAEA programme on chemical residues and pollution, and this was noted.

(iv) *CEE*. It was noted that CEE had desired one analytical method to be used for each pesticide. The view was reiterated by the Commission that it could not make such a recommendation on scientific grounds.

5. Submission of Reports

The Secretary requested that, in future, authors should submit with their reports, summaries of their content.

6. Recommendation of Analytical Methods

It was noted that various organizations continued to seek a single recommended method for the analysis of residues of a pesticide or group of pesticides. It was agreed unanimously that this was an undesirable and scientifically unsound aim, and an agreed statement on the subject was prepared (Appendix I).

7. Publication of Methods

It was agreed that it would be desirable to publish the Commission's recommendations on analytical methods as Technical Report appendices to the *IUPAC Information Bulletin*. The proposed authors of the reports for the 1974 meetings agreed to produce suitable summaries in advance of the meeting for assembly for this purpose.

8. Statistical Basis of Limits of Detection

There was brief discussion of this topic. Dr. GORBACH agreed to prepare a paper for discussion at the 1974 meeting, with possible assistance from Mr. ELGAR and Dr. HILL.

9. Organochlorine Compounds

Mr. ELGAR reported (see Appendix II) on progress with the multiresidue method recommended by the Commission in 1969 and set out in detail in the *Pesticide Analytical Manual* (Vol. 1). Since the last report studies had been carried out on the efficiency of extraction of organochlorine residues from crops and soil, alternative methods of column chromatographic cleanup, and further procedures for the confirmation of the identity of residues. Additional pesticides continued to be included in the scheme of analysis. Further studies on the separation and determination of the polychlorinated biphenyls (PCBs) were reported together with recent work on the occurrence and analysis of the dioxins and dibenzofurans. Discussion included mention of the use of dextran gels for cleanup. There was scepticism about the widespread use of Florisil and about the separation of PCBs from DDE using

silica gel. Dr. POLEN introduced a paper on the analysis of residues of technical chlordane (Appendix IIa). Dr. ABBOTT drew attention to a paper by SMART, HILL and ROUGHAM, to be published in *J. Assoc. Offic. Anal. Chem.*, comparing three methods for analysis of organochlorine compounds.

10. Organophosphorus Compounds

Dr. ABBOTT introduced papers on both multiresidue methods (Appendix III) and methods for individual organophosphorus compounds (see Appendix IV). Particular attention was drawn to the value of specific phosphorus detectors in gas chromatography of these compounds, which simplified cleanup procedures. Gel filtration had value in cleanup and liquid chromatography was showing promise. Thin layer chromatography (TLC) was very useful as a technique in analysis for organophosphorus compounds, and it was often as sensitive as any other procedure. Dr. HILL drew attention to low cost equipment now available for quantitative work using TLC. Dr. BÁTORA reviewed recent work from Eastern Europe on organophosphorus compounds (Appendix V) and Dr. POLEN introduced a short paper on analysis of phosvel residues. No new recommendations emerged as a result of work reviewed in these papers. Dr. FREHSE was preparing a paper on analysis of organophosphorus compounds for *Residue Reviews*.

11. Carbamate Compounds

Dr. ABBOTT introduced papers on these compounds (Appendix VI). Thin layer chromatography continued to be a much used method: preparation of fluorescent derivatives could be a useful adjunct. Gas chromatographic methods were also favoured, sometimes involving preparation of derivatives: rubidium sulfate thermionic detectors gave greater sensitivity to nitrogenous compounds than did caesium bromide detectors. Liquid chromatography was likely to be useful for carbamate analysis. Not much attention seemed to have been paid to the analysis of carbamate herbicides. Dr. HILL commented that AOAC was hoping to incorporate carbamates in its multiresidue procedures. Dr. ABBOTT drew attention to a paper on detector systems for organophosphorus and carbamate compounds [*Pestic. Sci.* **4**, 417 (1973)].

12. Fumigants

Mr. HEUSER introduced a paper on fumigant analysis (Appendix VII). He drew attention to the problem of "ageing" of residues, then discussed the analysis of phosphine, methyl bromide, and other fumigants, including multiresidue methods. Collaborative testing of a multiresidue method between eight laboratories in UK and Netherlands was in progress. Dr. HURTIG suggested that it was desirable that there should be greater participation in this kind of work by other laboratories.

13. Fungicides

Dr. GORBACH discussed the analysis of various systemic fungicides with special reference to benzimidazole derivatives and compounds which decomposed to such derivatives (Appendix VIII). Most methods were fluorimetric or colorimetric. Dr. RESNICK described recent work on dithiocarbamate fungicides, especially the analysis of the important decomposition product of the compounds, ethylenethiourea [J. H. ONLEY and G. YIP, *J. Assoc. Offic. Anal. Chem.* **54**, 165 (1971); J. H. NEWSOME, *J. Agric. Food Chem.*

20, 967 (1972); L. D. HAINES and I. L. ADLER, *J. Assoc. Offic. Anal. Chem.* **56**, 333 (1973); C. H. BLAZQUES, *J. Agric. Food Chem.* **21**, 330 (1973)]. Prof. KOIVISTOINEN and Dr. ABBOTT presented papers on the analysis of organotin compounds. The requirements of the FAO-WHO Joint Meeting for these compounds had now been met. Dr. ABBOTT mentioned a bibliography of organotin analysis prepared by LUIJTEN (Tin Research Institute, 1970). He also observed that the method of analysis of THOMAS and TANN [*Pestic. Sci.* **2**, 45 (1971)] seemed to be unreliable in that variable and high blanks could be obtained, with which view Dr. GORBACH concurred.

Prof. KOIVISTOINEN also reviewed methods for the analysis of captan, folpet, and captafol. The methods of POMERANTZ *et al.* [*J. Assoc. Offic. Anal. Chem.* **53**, 154 (1970)] would be recommended for regulatory purposes. An improved version of this method was described in *Analyst* [97, 713 (1972)].

14. Date and Place of Next Meeting

The next meeting would be during 1-4 October 1974 at ICI Plant Protection Ltd. (Jealott's Hill Research Station, Bracknell, UK).

Appendix I: General Statement on Methods of Residue Analysis

The Residue Analysis Commission of IUPAC was asked from time to time to suggest a single specified method for the analysis of residues of a pesticide or groups of pesticide, and it had noted that various organizations seemed to be seeking specific methods for regulatory purposes. The Commission wished to make its view on this subject widely known.

The Commission was convinced that such an aim was, in general, impossible to attain and led to confusion. Even if it was possible, it would be undesirable to specify methods rigidly, because they should be subject to improvements as analytical techniques advanced and experience was gained in working with them. It was the unanimous view of the Members of the Commission that *it is scientifically unsound, in most cases, to specify a single method for the analysis of a pesticide residue which can be applied to all substrates and under all conditions.*

It was certainly possible to recommend methods which had been used successfully on certain substrates in a number of laboratories. The Commission had made such recommendations in the past and it intended to produce short technical reports listing them: they would be kept under review in the light of changing techniques. However, such recommendations must be considered as guidelines for analysts, who must always test the methods in their own laboratories, making modifications as necessary to take account of differences in the nature of the samples being analyzed, and of the variations in equipment and chemicals which occurred between laboratories. It was equally important that the analyst carrying out the work should possess a high level of expertise in the field of residue analysis.

Appendix II: Multiresidue Methods of Analysis for Organochlorine Compounds

This report described the further progress made during the last year in the analysis of organochlorine compounds using the multiresidue method based on GLC with electron capture detection.

(i) *Extraction.* CARO (1) had compared four extraction procedures for root-translocated residues of dieldrin in maize, kale, alfalfa, and wheat. Blending with hexane-isopropanol (2:1) followed by Soxhlet extraction with chloroform-methanol (1:1) was satisfactory, while a good, quicker substitute for this two-stage technique was blending with acetonitrile-water (65:35).

Further work on the extraction of organochlorine pesticides from soil had confirmed that to obtain efficient recovery from field weathered samples, the residue must be desorbed from the soil particles. NASH *et al.* (2,3) studied three procedures and concluded that long shaking of a moist soil with a mixture of acetone and hexane (1+1) was the most effective. This method was to be studied collaboratively by AOAC. The rapid extraction of insecticides from soil using an ultrasonic technique had been further examined (4).

A rapid method for the extraction of organochlorine pesticides from fats and oils had been reported by ROGERS (5), in which a quantity of fat was distributed onto particles of a synthetic calcium silicate with a large surface area and the pesticide removed by blending with a mixture of acetone and acetonitrile (5+95). The pesticide was partitioned into hexane and cleaned up further by column chromatography. Essentially the same technique was studied by PORTER and BURKE (6), in which the fat was distributed on nonactivated Florisil and the pesticide eluted with a mixture of water and acetonitrile (1+9). Again the chlorinated residues were partitioned into hexane and cleaned up by column chromatography with activated Florisil before GLC.

(ii) *Cleanup.* MILLS *et al.* (7) had devised another solvent system for the elution of organochlorine pesticides from the standard Florisil cleanup column. Using 20% v methylene chloride in hexane, 50% v methylene chloride plus 0.35% v acetonitrile in hexane, and 50% v methylene chloride plus 1.5% v acetonitrile in hexane, were found to give superior cleanup of pesticides from fats and oils and recovery of pesticides with a wider range of polarity than the standard diethyl ether in petroleum spirit solvents. HALL had reported (8) some further work on the variability in the elution of pesticides from Florisil and the improvement in performance by hot water washing.

STALLING *et al.* (9) had investigated the use of crosslinked gels for cleanup. TINDLE and STALLING (10) had used this technique in automated apparatus. The recovery of a range of chlorinated pesticides from extracts containing corn oil was 93–100%. Some further work on the GLC separation of organochlorine insecticides from the elemental sulfur present in samples of waste water had been reported by BAIRD *et al.* (11). The sulfur was resolved from thirteen of the common chlorinated insecticides with a GLC column packing consisting of a mixture of three stationary phases (OV 17, QF 1 and DC 200).

(iii) *Analysis and Confirmation of Residues.* A collaborative study, using the AOAC multiresidue method that was recommended by IUPAC, had been reported by KRAUSE (12) on the determination of residues of Perthane, heptachlor epoxide, dieldrin, and mirex in apples and cauliflower, and Perthane in butterfat. Recoveries ranged from 91 to 105% with coefficients of variation from ± 7 to $\pm 15\%$. The Perthane was determined after dehydrochlorination following the procedure previously given by KRAUSE (13). The confirmation of organochlorine pesticide residues by the formation of chemical derivatives had continued to receive attention (14–22). Further investigations on the use of newer stationary phases for the resolution of those pesticides difficult to separate on GLC had been published by CONDOR *et al.*

(23) for heptachlor, oxychlordane and the chlordanes, and for aldrin and sulfur by LESTER and SMILEY (24).

(iv) *Polychlorinated Biphenyls and Terphenyls*. This group of chemicals had been extensively reviewed (25,26,27) and further data on the identity of the components present in the mixtures had been gathered (28,29) and their gas chromatographic characteristics studied (30,31).

Work had continued on the analysis of PCB residues and their interference with the determination of organochlorine pesticides. The separation of the pesticides and PCBs into groups by elution from silica gel with solvents of increasing polarity had been studied by LEONI (32). BERG *et al.* (33) had provided an alternative to the column chromatography on silica gel reported by ARMOUR and BURKE (34), in which the extract was absorbed onto a particular grade of charcoal, the chlorinated pesticides eluted with a mixture of ether and acetone, and the PCBs recovered subsequently with benzene. For the quantitative determination of the PCB residues both a catalytic dechlorination to bicyclohexyl and a perchlorination to decachlorobiphenyl with antimony pentachloride were used. MILES (35) had separated DDT and its analogues from PCBs by dehydrochlorination, followed by the chromic acid oxidation procedure reported by MULHERN *et al.* (36), which converted the DDT group to the corresponding dichlorobenzophenones, leaving the PCBs relatively unchanged. The oxidation procedure was also a part of a TLC method for polychlorinated biphenyls, naphthalenes, and terphenyls reported by BUSH and LO (37), while HANNON *et al.* (38) had used UV irradiation of trapped GC fractions to identify PCBs in the presence of organochlorine pesticides. DOLAN *et al.* (39) showed that by reducing the furnace temperature and the hydrogen flow rate in the Coulson electrolytic conductivity detector, the PCBs were preferentially reduced, leaving an acceptable response to organochlorine insecticides.

Other polychlorinated aromatics had been studied. ZITKO *et al.* (40) analysed polychlorinated terphenyls in birds and their eggs and also confirmed the residues by chlorination with antimony pentachloride.

GOERLITZ and LAW (41) had shown that chlorinated naphthalenes which interfere with the determination of chlorinated pesticides, contained three to six chlorine atoms.

(v) *Polychlorinated Dibenzo-p-dioxins and Dibenzofurans*. The chlorinated dibenzo-*p*-dioxins, which were powerful teratogens, might be present as contaminants in chlorophenols and in pesticides where chlorophenols were used as precursors. Work had been done on these compounds and the related dibenzofurans to determine their content in currently registered pesticides (42-45) and in food products (46). The determinations had been carried out by GLC with EC detection to a limit of determination of 0.05 mg/kg or lower. Confirmation of the identity of the residues had been carried out by several procedures, including GC-MS.

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Appendix IIa: Residue Analysis of Technical Chlordane

Because technical chlordane was a mixture, the analysis of its residues in a multiresidue analytical method gave rise to some complications. This might be the basis for omitting chlordane from presently accepted methods (1). This analytical problem had been studied further.

Tolerances for chlordane proposed by the FAO-WHO Joint Meeting of Pesticide Residue Experts (1970) were based on the sum of alpha-(*cis*) and gamma-(*trans*) chlordane in crops, plant tissues, and vegetable oils. In animal products, they recommended tolerances based on the sum of the chlordane isomers plus oxychlordane. Some investigators preferred also to measure heptachlor epoxide and nonachlor, if present. To measure all these components, two gas chromatographic columns (with electron capture detectors) had been found satisfactory: 3% OV-1 (or OV-101) on Gas chrom Q or

11% OV-17/QF-1 on Gas chrom Q (both at 190°)

Where oxychlordane determination was not required, as in the analysis of residues on plant products, the OV-1 (or OV-101) column was preferred. The chlordane isomers were clearly resolved and so was nonachlor. (Nonachlor might be obscured by the alpha-(*cis*) chlordane chromatographic peak if the OV-17/QF-1 column was used). Heptachlor and heptachlor epoxide were clearly resolved by the OV-1 (OV-101) column. For animal products the OV-17/QF-1 column was preferred, because it resolved oxychlordane from heptachlor epoxide, and the two chlordane isomers were well resolved.

Qualitative identification of residues of technical chlordane, to distinguish them from other organochlorine pesticides or PCBs, could be achieved by several techniques.

TLC-parameters, related to the R_f of TDE, on alumina thin layer plates (2% acetone in *n*-heptane for development) were as follows:

Compound	R_f/R_f TDE
Heptachlor epoxide	0.9
Oxychlordane	1.3
Gamma-(<i>trans</i>)chlordane	1.1
Alpha-(<i>cis</i>)chlordane	1.1
Nonachlor	1.2
Heptachlor	1.4

P-values (2) for technical chlordane components or their transformation products had also been identified. For the acetonitrile-hexane solvent pair, these values were:

<u>Compound</u>	<u>P-values</u>
Heptachlor epoxide	0.26
Oxychlordane	0.41
Gamma-(<i>trans</i>)chlordane	0.44
Alpha-(<i>cis</i>)chlordane	0.35
Nonachlor	0.48
Heptachlor	0.53

Derivatization in a solid matrix for the confirmation of components of residues of chlordane had been suggested (3). Several of the compounds exhibited new chromatographic peaks, often with the disappearance of the parent peak, after passing through heated columns packed with alumina-potassium hydroxide or alumina-potassium *tert*-butoxide.

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Appendix III: Multiresidue Methods of Analysis for Organophosphorus Compounds

Extraction and Cleanup Procedures. WATTS (1) examined two rapid extraction procedures using ethyl acetate or acetonitrile and also Soxhlet extraction with 10% methanol in chloroform. Using ¹⁴C-labelled and unlabelled residues, he found that the extraction efficiencies for the three methods were very similar, about 90% for malathion and phosphamidon on bean leaves and essentially 100% for azinphosmethyl, parathion, and malathion on field treated kale. Such studies were extremely useful and should be extended.

Low temperature cleanup of biological samples for pesticides and their metabolites had been published by MCLEOD and WALES (2). Polar and apolar pesticides could be separated from sample lipids, waxes, and water by solvent extraction and precipitation at -78°C. After special filtration the extract was suitable for GLC determination with electron capture or flame photometric detectors. Recoveries of 13 pesticides, including malathion, parathion, phosphamidon, and fenitrothion, ranged from 80-116%.

Column cleanup was still widely used and VERSINO *et al.* (3) undertook a study of 8 of the more common adsorbents. They concluded that "all Florisil" columns were less suitable for cleanup of phosphorus-containing pesticides than mixed columns. STORHERR *et al.* (4) had modified their charcoal column cleanup multiresidue method and high recoveries were obtained for 41 organophosphorus pesticides and alteration products added to kale. LEONI (5) used a silica gel microcolumn for the separation of 50 pesticides and related compounds and polychlorinated biphenyls. The method was particularly useful in water pollution studies and involved separation into four groups according to polarity, followed, in most cases, by electron capture gas chromatography.

A gel filtration cleanup procedure for organophosphorus pesticides in rice had been developed by MASUD *et al.* (6). Bio-Beads S-X8 and Sephadex LH-20 columns were used and recoveries for multiple residues of malathion, fenitrothion and dichlorvos at the 5 mg/kg level were 77–104%.

The choice of a particular solvent and a suitable pH for the liquid-liquid extraction of organophosphorus pesticides from water were discussed by SUFFET and FAUST (7). Specific conditions for the extraction of the parent, oxon and hydrolysis products of diazinon, parathion, malathion, and fenthion, were given. Details of hydrolysis rates and solvent partition of phosdrin and related organophosphorus pesticides had been published by SEIBER and MARKLE (8). An automatic apparatus based on sweep codistillation had been developed by PFLUGMACHER and EBING (9) for the cleanup of crude extracts containing pesticide residues. Extracts from 13 crops containing 27 organophosphorus compounds were cleaned up using this technique.

Thin-Layer Chromatographic Methods. Following GARDNER's work (10) on the two dimensional TLC-cholinesterase inhibition detection procedure, involving the separation of 26 organophosphorus pesticides, MENDOZA and SHIELDS (11) examined the factors affecting the specificity and sensitivity of different esterases to organophosphorus pesticides. Bee head esterase was the most sensitive, but beef liver esterase was more useful because it reacted quicker. The fluorimetric determination of some organophosphorus pesticides in solution had been carried out by MARTIN (12). The method involved the inhibition of the lipase hydrolysis of fluorescein dibutyrate and possibly could be extended to thin layer multiresidue detection. A relatively new technique was derivative formation followed by fluorogenic detection. FREI and his coworkers (13) found that fluorescent spots were obtained when organophosphorus compounds on a silica gel plate were sprayed with a 3-hydroxyflavone, such as robinetin, after bromination. Instrumental detection limits were around 0.04 µg per spot for certain pesticides. Metallofluorescent indicators had also been used (14). Pesticides displaced palladium from a nonfluorescent indicator complex of Pd(II)-Calcein or Pd(II)-Calcein Blue, resulting in a fluorescent spot. Quantitative measurements were made *in situ* and the detection limits for phosphorothioates were 50–100 ng and for phosphorodithioates 10–50 ng. A more conventional routine TLC method for organophosphorus pesticides (15) and a screening method for fruit and vegetables (16) had also been published.

Theoretical aspects, including the respective contributions of inductive and steric effects in the separation of neutral organophosphorus pesticides, were discussed in two articles by LAMOTTE *et al.* (17,18). Malathion, parathion, parathion-methyl bromophos, diazinon, fenthion, and phenthapton present in food and water had been determined by JOVANOVIC and PROSIC (19) using Silica gel F plates and palladium chloride as a visualizing agent. The limit of detection was *ca.* 0.1 mg/kg for each pesticide.

Gas Chromatography Methods. The use of more specific and sensitive GLC detectors for organophosphorus pesticides had led to less stringent cleanup procedures being required. BOWMAN *et al.* (20) examined 39 foods using four extraction procedures, followed by hexane-acetonitrile partition, and temperature programmed gas chromatography. They used dual mode flame photometric detection without any column cleanup. Very little interference was observed with 90% of the samples in the phosphorus mode and nearly 70% of the samples in the sulfur mode. The lower limits of detection for most pesticides were 0.01–0.05 mg/kg and 0.02–0.1 mg/kg in the phosphorus and

sulfur modes, respectively. BOWMAN and BEROZA (21) had improved the gas chromatographic separation using Dexsil 300 on a specially washed Chromosorb W support. Retention times for 146 pesticides were given, together with recoveries of 10 pesticides from milk at the 0.25–0.01 mg/kg level (73–98.1%). The AOAC method of pesticide residue analysis (22) was official for 7 organophosphorus pesticides in a limited number of crops. PARDUE (23) had evaluated this method for 60 organophosphorus pesticides and quantitatively recovered 13 of them, with partial recovery of 9 others. His studies were, however, on standard compounds in the absence of crop material. Such investigations were of considerable value and should be expanded in scope to include different types of sample.

The use of more specific detectors reduced the problem of positive identification but confirmation procedures, such as chemical derivitization, were still necessary in multiresidue analysis. SHAFIK *et al.* (24) had reported optimum conditions for hydrolysis to the corresponding dialkyl phosphate or thiophosphate derivatives and for esterification before gas chromatography.

SCHEIDE and GUILBAULT (25) had developed a piezoelectric detector for organophosphorus compounds. Frequency changes of a vibrating crystal placed in the column were monitored continuously. GREENHALGH and COCHRANE (26) had compared the response of alkali flame and electrolytic conductivity detectors to organophosphorus compounds containing nitrogen. Greater sensitivity was obtained with the alkali flame detector. KIRKBRIGHT *et al.* (27) had investigated the use of a high frequency plasma discharge detector for organophosphorus pesticides, the induced atomic emissions being measured quantitatively.

Details of a purpose built gas chromatograph for the collection and detection of the degradation products of organophosphorus pesticides had been published by MACHIN and MORRIS (28). Special features included an all glass system, an exceptionally short path from the column to the detector and a trapping device from 0.1 to 50 µg of eluant. By measuring the emission of S₂ and HPO radicals formed from different sulfur and phosphorus species in low temperature flames (Salet phenomena), VEILLON and PARK (29) had satisfactorily analysed sulfur- and phosphorus-containing compounds, including diazinon in aqueous and organic samples. A special flame spectrophotometer, which did not require cooling water, had been developed by GUTSCHE and coworkers (30) for the analysis of phosphorus- and sulfur-containing insecticides. A limit of detection of 0.09 µg of trichlorphon (≡0.01µg of P) was obtained.

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Appendix IV: Residue Analysis of Individual Organophosphorus Compounds

Dichlorvos residues on foodstuffs had been determined by ELGAR (1) using a flame photometric detector. The UK Panel on Malathion and Dichlorvos Residues in Grain (2) had published its GLC method. The use of methanolic extraction without further cleanup and a succinate ester type of GLC column was recommended. The phosphorus sensitive thermionic detector was used by MACHIN *et al.* (3) when examining blood samples for dichlorvos and diazinon. A special sweep codistillation method for the extraction and cleanup of chlorpyrifos (Dursban) had been developed by MAINI *et al.* (4) and used in the determination of residues (5). Conditioning of polyalkyl glycol phases for the flame photometric detection of chlorpyrifos and its oxygen analogues had been investigated by STRUBLE (6). A detection limit of 10 pg was achieved by UK and HIMEL (7) for chlorpyrifos in treated houseflies when using a nickel-63 electron capture detector. STELLER and PASARELA (8) examined plant and animal tissue, milk, and eggs for the presence of dimethoate and dimethoxon, using flame photometric and alkali flame ionization detectors. SAHA *et al.* (9) evaluated the efficiency of various extraction and cleanup methods for determining residues from wheat plants grown in soil treated with Dyfonate. Monocrotophos derivatives present in treated crops had been analysed using a TLC method by BEYNON *et al.* (10). Photoalteration products of parathion had also been determined by TLC

by JOINER and BAETCKE (11). A gas chromatographic method involving TLC cleanup and flame photometric detection had been used by BURKHARD and VOSS (12) for examining animal tissue, fat, and milk for residues of iodo-fenphos and two metabolites. Bromophos and bromophosethyl were the subject of a review article by EICHLER (13). Malathion residues in cereal products were determined colorimetrically with a sensitivity of 1 mg/kg by PIEKACZ and MAZUR (14). Fensulfothion and its sulphone present in muck soil had been determined by WILLIAMS *et al.* (15), using a GLC technique with flame photometric detection. A similar detector was used by LUBKOWITZ *et al.* (16) for the determination of methamidophos residues.

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Appendix V: Residue Analysis of Organophosphorus Compounds Reported in Eastern Europe

Methods had been published for the analysis of butiphos (1,2), dichlorvos (3,4), demuphos (5), dimethoate (6,7), fenitrothion (8,9), fenthion (10), isophos-2 (11), malathion (12,13), menazon (14), parathion and methyl parathion (15,16,17), phentoate (18), phosalone (19,20), and phosmet (21).

In the case of multiresidue methods, extraction and simultaneous cleanup of samples had been effected by using a column of a mixture of sample and silica (22). A comparative study of different extraction and cleanup procedures for residues had been published (23). Separation by TLC combined with enzymatic detection had been used as a sensitive method for residues of butonate, trichlorphon, and dichlorvos in milk (26). The procedure was improved for routine screening (27). On the basis of chromatographic behaviour of organophosphorus compounds (OP) in different solvent systems,

relationships were shown between chemical structure and R_f values and the most suitable working conditions were established for different chromatographic systems (29).

Work on the comparison of lower limits of detection for insecticides by TLC and bioassay methods had been published (30). According to the results obtained, the bioassay method using mosquito larvae could be considered superior to TLC methods. Methods for the identification of 23 organochlorine (OC) and OP pesticides had been described (31).

Work was in progress on the analysis of multiple residues of OP's and their oxidative metabolites in agricultural crops (34,35). The compounds included in this study were: carbophenthion, disulfoton, fenitrothion, malathion, phorate, phosmet, and thiometon. The multidetection system studied consists of: (a) column chromatographic extraction and simultaneous precleaning (22,23); (b) cleanup by liquid-liquid partitioning and by Florisil-column chromatography using gradient elution; (c) PC and TLC confirmatory tests; (d) quantitative analysis including GLC with CsBr-TI detector for parent compounds and the modified colorimetric-enzymatic method for determining both the parent compounds and the sum of oxidative metabolites or individual metabolites after their elution from the chromatogram.

Other work on mutiresidue methods included: methods using TLC for OP compounds in soil (24,28), semiquantitative methods for 15 compounds (25), and GLC methods (32,33).

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Appendix VI: Residue Analysis of Carbamate Compounds

EL-DIB and ALY (1) had proposed a colorimetric method for the determination of phenylamide pesticides in natural waters. At 150° and in acid the phenylamides were hydrolysed to the corresponding anilines. These were diazotized and coupled with 1-naphthol to give intensely coloured azo dyes, which could be measured spectrophotometrically. The sensitivity of the method was 0.02 mg/l. The determination of carbamate herbicides residues in soil had been carried out by SPENGLER and JUMAR (2) using spectrophotometry followed by confirmatory TLC. The method involved conversion of the extracted pesticides to aniline or substituted aniline. The amine was diazotized and coupled with thymol, subjected to cellulose column cleanup, and determined spectrophotometrically.

Conventional colorimetric methods for the determination of chlorpropham residues in alfalfa were often ineffective due to variable and excessive amounts of interfering plant material. ERCEGOVICH and WITKONTON (3) proposed an improved method in which the residue was directly hydrolyzed in the crop sample to 3-chloraniline and extracted into a nonpolar solvent by steam distillation. The *N*-ethyl-1-naphthylamine complex was formed and separated from interfering coloured complexes by cellulose column chromatography before the spectrophotometric measurement. The sensitivity of the method was 0.02 mg/kg using 25-g samples of alfalfa. MUMMA and KHALIFA (4) obtained the mass spectra of the trifluoroacetyl derivatives of carbaryl and metabolites. Predictable fragmentation patterns were found and the data obtained could be useful in the identification of the metabolites of other *N*-methyl carbamates. Mass spectrometry and infrared spectrometry were used by SU and ZABIK (5) to identify the photolysis products of the new pesticide *m*(*N,N*-dimethylformamidine)phenyl-*N*-methyl carbamate hydrochloride.

MENDOZA and SHIELDS (6) investigated the determination of selected carbamates by the thin layer enzyme inhibition technique (TLC-EI). The inhibition of esterase activities by these carbamates was also determined by spectrophotometry using indophenyl acetate substrate. Multipesticide extraction and low temperature cleanup was used with TLC-EI to estimate the recovery of methomyl from spiked food samples. Results were 80% for 0.5 mg/kg spiked samples and 60–90% for the 0.05 mg/kg level (7). TLC-EI was used for the detection of methomyl and oxime after addition of methomyl to rapeseed oils and meals; detection was also obtained by iodo or chloroplatinate spray reagent. The enzymatic method was 100 times more sensitive (8). The use of phosphatase in the thin layer enzymatic detection of insecticidal and herbicidal carbamates was investigated by GEIKE (9). The sensitivity to insecticidal carbamates was greater with acid phosphatase than with alkaline phosphatase. EBING (10) published a routine method for the identification of residues of various pesticides including carbamates. Two or three TLC systems selected from a choice of ten should enable the identification of the unknown pesticide to be made unambiguously.

In order to develop an analytical method, MALLETT *et al.* (11) investigated the natural fluorescence of a number of pesticides. Measurements were made directly from a TLC plate. It was also shown that physical treatment, such as heating, could alter the fluorescence characteristics and might be used in a confirmatory way. The florigenic labelling of nonfluorescent carbamates followed by thin layer chromatography and *in situ* fluorimetry was a method that had come to the fore due to the extensive work of FREI, LAWRENCE and LEGAY. They applied it to Matacil and Zectran (12), carbamates, and urea herbicide (13), *N*-methyl and *N,N*-dimethyl carbamates (14). They also investigated the properties of the dansyl (5-dimethylaminonaphthalene-1-sulphonyl) chloride derivatives including their fluorescence phenomena (15), TLC properties (16), and *in situ* determination (17). The latest development involved the use of 4-chloro-7-nitrobenzo-2,1,3-oxadiazole to form the highly fluorescent derivatives of *N*-methyl and *N,N*-dimethyl carbamates (18). Unlike dansyl chloride, it did not form fluorescent derivatives with phenols, thiols, or anilines; also its hydrolysis product was nonfluorescent.

LOCKE (19) examined 15 solvent systems when seeking a method to distinguish *N*-hydroxy *N*-methyl carbamate from other carbaryl metabolite aglycones.

WILLIAMS (20) reviewed the determination of carbamate insecticide residues in plant material using gas chromatography. A useful discussion of detectors, derivatives, extraction, and cleanup was given, together with a list of GLC columns for carbamates and their derivatives and methods of extraction from a variety of crops. The conclusion reached was that at present there was no general GLC method applicable to all carbamates and substrates.

OLNEY and YIP (21) reported the gas chromatographic determination of carbamate herbicides in food crops. The samples were extracted with ethanol or ethanol-water mixture, followed by a magnesium oxide-cellulose column cleanup. After concentration, 8 of the carbamates were detected by a KCl-RbSO₄ thermionic detector and the chlorine-containing dichlormate determined by an electron capture detector. A flame photometric detector was used to confirm sulfur-containing carbamates. Recoveries at the 0.01-10 mg/kg level were better than 80% for the crops used. The Coulson electrolytic conductivity detector had also been used (22) but appeared to lack sensitivity.

The formation of electron capturing derivatives of carbamates and their metabolites and subsequent GLC determination continued to be a popular technique. The following derivatives of carbaryl had been used: *N*-perfluoroacetyl (23), trifluoroacetyl, heptafluorobutyl, and chloroacetyl (24) and 2,6-dinitro-4-trifluoromethyl phenyl ethers (25). For the determination of Baygon and its metabolites in animal tissue and milk (26) and plant tissues (27), the trichloroacetyl derivative was utilized. Barban and its major water-soluble metabolites were determined in grain and sugar by HARRIS and WHITEOAK (28). Hydrolysis and bromination gave tribromochloroaniline, which was detected at a limit of 0.01 mg/kg using GLC with electron capture detection.

Carbetamide [D(-)-phenylcarbamoyloxy-2-(*N*-ethyl propionamide)] and its aniline metabolite could be separated from crop extracts by liquid-liquid partition. Ethylamine and aniline were liberated by acid hydrolysis and converted to the corresponding amides with 4-bromobenzoyl chloride, which could be detected by an electron capture detector at a limiting concentration of 0.05 mg/kg (29).

The flame photometric detector had been used for the determination of methomyl in mint hay and oil (30), aldicarb in soil, cotton seed, and cotton lint (31), and 3-sec-butylphenyl *N*-methyl-*N*-thiophenyl carbamate in water, soil, and vegetation (32). The direct gas chromatographic determination of methomyl with a microcoulometric nitrogen detector had been reported by WILLIAMS (33), but this method had not yet been applied to plant material. CERNY and BLUMENTHAL (34) used a rubidium sulfate tipped flame ionization detector, which was sensitive to nitrogen compounds, to determine propham and chlorpropham in potatoes.

Methomyl residues had been determined in various food products (35). After extraction and low temperature cleanup, the chloroform extract was analysed using a TLC-enzyme inhibition technique and GLC determination of an oxime derivative using sulfur and nitrogen detectors. A multiresidue method based on the conversion of methyl carbamates to their 2,4-dinitrophenyl ether derivatives, suitable for determination by electron capture gas chromatography, had been proposed by HOLDEN (36). Residues might be determined at levels as low as 0.05 mg/kg and recoveries ranged between 90 and 110%.

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Appendix VII: Residue Analysis of Fumigants

A survey of analytical methods for fumigants and their residues had been published by MALONE (1), in which it was stressed that test residues to be recovered must be present in the form in which they would occur in practice, *i.e.*, produced by fumigation and subsequent "ageing". These principles had been reiterated by HEUSER (2, 3).

Residues from Use of Phosphine

To distinguish chemical residues from naturally occurring phosphorus compounds, DISNEY and FOWLER (4) and ROBINSON and BOND (5) used ^{32}P -phosphine to determine if the gas was irreversibly sorbed on cereals and the magnitude of any residue produced [following earlier work by BERCK (6) and DIETERICH *et al.* (7)]. Both groups found indications of irreversible sorption of phosphine on wheat, but the techniques used were later questioned by RAUSCHER (8), who postulated that $^{32}\text{PH}_3$ might give results differing from those obtainable with unlabelled phosphine because of (a) self decomposition or oxidation due to radiation, and/or (b) isotope exchange with naturally occurring ^{31}P in the fumigated material. More recently, DISNEY and FOWLER (9,10) and ROBINSON (11) had shown that such phenomena did not occur and results obtained with $^{32}\text{PH}_3$ accurately reflected the behaviour of unlabelled phosphine. ROBINSON (11) used a substrate (cellulose) free from naturally occurring phosphorus to demonstrate irreversible take-up of normal phosphine, using a neutron activation technique.

TKACHUK (12), using gel permeation chromatography to separate the protein of $^{32}\text{PH}_3$ -fumigated wheat fractions and of fumigated bovine haemoglobin from low molecular weight components, showed that the haemoglobin protein fraction became labelled with phosphorus-32, whereas the wheat (bran) protein did not. He also used silica gel TLC to identify hypophosphite and indicated the presence of orthophosphate or pyrophosphate in the lower molecular weight fractions, in agreement with the earlier findings of ROBINSON and BOND (5).

Residues from Use of Methyl Bromide

(a) *Bromide Ion* (also arising from use of ethylene dibromide). The method of HEUSER and SCUDAMORE (13) for determination of bromide ion, by reaction with ethylene oxide followed by GLC, had been used to estimate "inorganic bromide" in food by SCUDAMORE (14) and by KEMPSTON and MAW (15). The method gave results comparable with those obtained by the wet chemical/ashing/oxidation method (16). DUMAS (17) determined "inorganic bromide" in fruits containing both bromide ion and free ethylene dibromide after fumigation with the latter, using alcoholic sodium hydroxide digestion before

ashing and oxidation, but found that some organic bromide was lost and the remainder was included in the total bromide figure. This emphasized the doubtful value of this well established "total bromide" method when organic bromide was present. Oxygen combustion was substituted for the wet ashing procedure by BROOKES and MARTIN (18) in the determination of total bromide in barley and malt.

(b) *Alkylation Reaction Products.* Methods for the determination by GLC of reaction products of methyl bromide with protein aminoacids (e.g., of grain) were being investigated by SCUDAMORE and HEUSER (13) and SCUDAMORE (14) was investigating aminoacid reaction products of methyl bromide or other alkylating compounds prior to GLC. COO-methylated products of a number of methyl bromide treated pure amino acids had been detected in this way.

Reaction Products of Other Fumigants

STIJVE and CARDINALE (19) determined 2-acetoxyethanol, formed from acetic acid naturally present in cocoa beans and powder by its reaction with ethylene oxide during fumigation. They employed the multiresidue detection method of HEUSER and SCUDAMORE (20), using a flame ionization GLC detector. SCUDAMORE (14) determined ethylene chlorohydrin produced in cocoa butter by ethylene oxide treatment, by GLC and BROBST and TAI (21) determined 1-chloro-2-propanol and 2-chloro-1-propanol (propylene chlorohydrins) in starch previously treated with propylene oxide, by acid hydrolysis of the starch, followed by ether extraction and GLC of the ether extract. BERCK (22) found that the chromatograms obtained by GLC after pyrolysis of seeds (wheat, rapeseed, flax), which had received prolonged aeration after treatment with CT-EDC-EDB mixtures, showed changes from the pyrogrammes of the untreated seed and suggested that changes in the seed due to fumigation might ultimately be identified in this way.

Residues of Unchanged Fumigants (including multidetection methods)

BERCK (22) had reported satisfactory recovery of residual fumigants from treated wheat, flax, and rapeseed by prolonged extraction with acetone:water at low temperature, followed by GLC. Residues of carbon tetrachloride, ethylene dibromide, methyl bromide, and phosphine were recovered satisfactorily, but residues of ethylene dichloride were not detected with adequate sensitivity by either EC or flame ionization detectors. DUMAS (17) estimated the amount of free methyl bromide in fumigated apples by allowing it to desorb from the fruit held in a sealed jar. Bromide ion was then determined coulometrically after absorption in sodium hydroxide. DUMAS (17) determined free ethylene dibromide in fumigated apples by the method of KENNETT and HUELIN (23), followed by hydrolysis to bromide ion and coulometric titration. MCMAHON (24) reported GLC determination of residual carbon tetrachloride, carbon disulfide, and ethylene dibromide, from commercially held grain stocks. RANGASWAMY *et al.* (25) had determined residues of methyl iodide in sorghum and rice, by a colorimetric method, by extraction and LOPEZ-ROMAN *et al.* (26) estimated free hydrogen cyanide residue in fumigated lemons by GLC. Under the auspices of the UK Ministry of Agriculture, Fisheries, and Food, collaborative testing between 8 official laboratories in UK and Netherlands was commenced in 1973 of the multiresidue GLC method of HEUSER and SCUDAMORE (20) for unchanged fumigant residues in foodstuffs.

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Appendix VIII: Residue Analysis of Systemic Fungicides

The systemic fungicides, especially the benzimidazole derivatives, were becoming widely used and a number of residue analytical methods were available.

Benomyl [methyl-1-(butylcarbomyl)-2-benzimidazole carbamate] and *MBC* (methyl-1-benzimidazol-2-yl carbamate:Carboxine). A fluorimetric and colorimetric procedure for determining benomyl residues had been published by PEASE and GARDINER (16). Benomyl residues were extracted from the sample and converted to MBC by hydrochloric acid treatment. The acid solution of MBC was extracted with hexane for cleanup and afterwards saponified to 2-aminobenzimidazole by boiling with sodium hydroxide. Following cleanup

by partitioning, the determination was carried out by direct fluorimetric measurement or colorimetric analysis after bromination. A sensitivity of 0.1 mg/kg was claimed. This method was tedious for daily routine analysis and PEASE and HOLT (15) had simplified the extraction procedure.

For distinguishing benomyl from 2-(4-thiazolyl)- and 2-(4-furyl)-benzimidazole, differential fluorimetry in basic and acidic medium was used. Another modification of the bromination method of PEASE and GARDINER had been published by MARTENS and CUS (11). 2-Aminobenzimidazole could be brominated in the presence of benomyl, and so could be determined by omitting hydrolysis. MBC was the primary decomposition product of benomyl, and its residues could be determined with the same methods as were used for benomyl. In addition to the above methods a spectrophotometric method was used in some laboratories (9). The detection limit was reported to be 0.05 mg/kg and the recoveries averaged 90%. MARTENS and CUS (11) published a similar method and a polarographic determination of thiophanate. To detect benomyl and MBC when other systemic fungicides were present, STRYK (20) used a two-dimensional thin layer chromatographic method. Compounds were detected by UV light, or by a spray of *N*-2,6-trichloro-*p*-benzoquinoneimine. Another residue method based on TLC separation was published by VOGEL *et al.* (21). KIRKLAND (10) had described a method using high speed liquid chromatography for separation and determination. Benomyl and/or MBC, methyl-5-hydroxy-2-benzimidazole carbamate, and methyl-4-hydroxy-2-benzimidazole carbamate as possible metabolites could be determined together in cow milk, tissues, urine, and faeces. The sample was hydrolyzed in aqueous acid to convert benomyl to MBC and to liberate the metabolites from conjugates. After a cleanup by partitioning, the compounds were separated by high speed cation exchange liquid chromatography and detected with a UV detector: detection limits were 0.05-0.1 mg/kg. No interference was observed from 28 other plant protection chemicals.

STIPES and ODERWALT (19) used soil thin layers as a tool in predicting the movement of fungicides (benomyl, captan, thiabendazole) in soil. Visualization was achieved directly with UV light and indirectly with bioautography in which *Penicillium expansum* conidia were sprayed onto the developed chromatogram. A bioassay with spores of *Alternaria tenuis* and *Penicillium expansum* was reported by CHANCOGENE and GREDT (3). A zone of inhibition was observed at concentrations above the lethal dose. This bioassay could be used to determine how far the fungicides had moved within plants. Plant fragments were placed on a culture, inoculated with the spores of the test fungus. RIESSELMAN and WEIHING (17) reported the use of *Cercospora beticola* as a bioassay organism. Areas of zones of inhibition on V-8-agar plates were measured with a planimeter.

Thiabendazole [2-4'-thiazolyl)-benzimidazole]. Residue analytical methods (8) were mainly based on photometric determination of the compound after extraction and cleanup and a detection limit of 0.1 mg/kg was reported. A similar method was reported by NORMAN *et al.* (14) with a detection limit of 0.2 mg/kg. An automated version of the AOAC colorimetric method for the determination of thiabendazole in feedstuffs had been described by WHITE (22) and bioassay methods had been described by RIESSELMAN *et al.* (17), ERWIN *et al.* (4), and SOLEL *et al.* (18). A bioautoradiographic method on soil thin layer chromatograms using *Penicillium expansum* had been published by STIPES *et al.* (19).

Thiophanate [1,2-bis(3-ethoxycarbonyl-2-thioureido)-benzene]. Basic information on the impact of thiophanate on the environment was given by NOGUCHI *et al.* (13). All the residue data presented were derived from experiments with radiolabelled thiophanate. Important for general residue analysis was the information on the metabolites which were present, including dimethyl 4,4'-*o*-phenylene-bis(allophanate), methyl-2-benzimidazole carbamate (MBC), 5-hydroxy-methyl-2-benzimidazole carbamate, and various conjugates of the latter. TLC separation methods were described. An oscillopolarographic residue analytical method had been reported by MARTENS *et al.* (12). MBC and 2-aminobenzimidazole did not interfere. Photometric methods for the determination of MBC and 2-aminobenzimidazole were also described and a thin layer chromatographic method had been published by STRYK (20).

Fuberidazol [2-(furyl)-benzimidazole]. Methods for determination by TLC followed by spectrophotometry were described by FRANK (5). The separation (gel chromatography), detection (UV), and identification (IR,MS) of metabolites had also been described.

Pyrazophos [2-(*O,O*-diethylthionophosphoryl)-5-methyl-6-carbethoxypyrazolo-1,5,6-pyrimidine]. Residues of pyrazophos were determined (6) by GLC with a flame photometric detection after a chromatographic cleanup on a polystyrene gel.

Pyracarbolid (2-methyl-5,6-dihydro-4-*H*-pyrane-3-carbonicacid-anilide). GORBACH (7) showed that pyracarbolid residues could be determined with the well known BLEIDNER method (2) for urea herbicides. The aniline moiety was diazotized and coupled with *N*-(1-naphthyl)-ethylenediamine dihydrochloride, which was determined colorimetrically.

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SECTION ON ORGANIC COATINGS (VI.6)

23-26 August 1973

Present: Mr. P. H. FINK-JENSEN (Chairman), Mr. A. R. H. TAWN (Vice-Chairman), Dr. U. ZORLL (Acting Secretary), Dr. J. A. W. VAN LAAR, Dr. L. A. O'NEILL, Mr. V. ZVONAR (Titular Members); Mr. G. CHRISTENSEN, Dr. K. M. OESTERLE, Prof. D. PAGANI, Mr. H. K. RAASCHOU NIELSEN, Dr. D. WAPLER (Associate Members); Dr. H. SPOOR (National Representative); Prof. A. BJÖRKMAN (Observer).

The Chairman asked all Members to be silent in memory of the late Dr. H. W. TALEN, who had been an active Member of the Organic Coatings Section (OCS) over many years.

1. Minutes of Previous Meeting

The minutes of the meeting held at Florence on 16 June 1972 had been published in *Information Bulletin* No. 44 (December 1972), pages 41-42.

2. Future Organization

The future of the Section was discussed at length, because its affiliation to the Applied Chemistry Division would terminate at the end of the present meeting. The possibilities to join the Macromolecular Division (MMD) were treated partly in the presence of Prof. A. BJÖRKMAN who, as a Member of MMD as well as of the Finance Committee, was able to give valuable suggestions on this matter. Several aspects of an integration of the group into MMD had already been prepared by correspondence between the Chairman of OCS and Officers of MMD, in particular Profs. H. BENOÎT, C. G. OVERBERGER, and A. BJÖRKMAN. The pertinent letters were read and discussed.

After a preliminary meeting between the officers of OCS and MMD, the result of the discussions was that the most promising procedure would be to join MMD as a Working Party, responsible directly to the Macromolecular Division Committee, because such a group would have sufficient freedom to define and carry out its scientific and technical work. Because no financial support could be expected from MMD, the group should, until it was transformed subsequently into a Commission, depend on the facilities to which its Members had access.

It was decided further that the name of the group should be "Working Party on Supported Polymer Films" (SPF). In a joint meeting with MMD (see page 174), it was decided to consummate the integration according to these proposals. Mr. FINK-JENSEN (Chairman of the new Working Party) would become a Coopted Member of MMD. He thought it advisable to have additional support from a Vice-Chairman. For this task, Mr. TAWN was reelected. Mr. A. TOUSSAINT wished to resign as the group's Secretary, so Dr. ZORLL was assigned to that office.

The development of links to other scientific and technical bodies, in particular to FATIPEC, SLF, OCCA, and FSPT, which had been well developed during the last 3 years, was still considered of utmost importance to the coatings field and in the end to IUPAC. Because certain activities might not fit into an MMD scheme, the proposal of the OCS Chairman to form another body, the Organic Coatings Science Group (OCS Group), was adopted. In principle, all Members of the former OCS would become Members, while only those taking part in current work within the MMD

scheme should be considered Members of SPF. Thus, SPF became one of the activities of the OCS Group. The Officers would be the same as those of SPF. If necessary, further specialists with a particular background for the work in mind should be asked to join the OCS Group and Dr. OESTERLE proposed to awake interest for the work especially among younger colleagues. Moreover, it was felt necessary to ask those Members, who neither attended meetings of the group nor gave active support to its work, about their intentions as to further participation.

3. Status of Projects

Reports were presented by the project leaders about the present state of their scientific and technological programmes of work.

- (i) On behalf of the Analytical Group, Dr. O'NEILL reported about completion of the work concerning the analysis of alkyd resins, the results of which had already been published [*Pure Appl. Chem.* **33**, 411 (1973)]. The results of the cooperative experimental work on acrylics were ready, though not yet published. Similar experiments on polyurethanes were virtually finalized, while those on polyamides were still going on.
- (ii) Dr. VAN LAAR reported that the group concerned with Adhesion had continued to collect information, but there was some uncertainty as to how it should be condensed into a publication. An extensive report about adhesion measurements was given by Dr. WAPLER. He emphasized that much more attention should be given to the stress field within the paint layer on performing such tests in order to obtain really meaningful results.
- (iii) With respect to the programme of providing information about Postgraduate Education, Mr. TAWN reported in place of Prof. K. HAMANN, who was unable to attend. Thus far, such data could only be given for UK and Federal Republic of Germany: the list should be completed so as to include various other countries as well. Problems of recognition of education grades across borders should also be given adequate attention.
- (iv) The programme about Information Retrieval had made substantial progress, as reported by Mr. RAASCHOU NIELSEN. Extensive work by means of questionnaires had resulted in a substantial collection of data about national centres all over the world, providing information about the retrieval of technical literature within the paint and ink field.

4. Future Work

The discussion about further work was concentrated on the future of the present programme and possible new projects suitable with respect to the MMD scheme. In the latter category, two particular topics were selected from the list set up at the 1972 Teddington meeting [see *Inf. Bull.* Nos. 42/43 (July 1972), pages 13–17] for MMD as suggestions for SPF contributions. One theme was that of Polymer-Solvent Interaction, which was supported by many Members because it was not only of scientific importance but also essential in technological terms. It could affect the suitability of printing inks intended for use on food wrappings. Work on this project should be assigned to Members of the Analytical Group and others who, like Dr. VAN LAAR, could provide theoretical assistance, or like Dr. OESTERLE, who

could contribute mechanical test results. The other topic was the behaviour of Concentrated Polymer Solutions, in particular paints and polymer solutions containing a certain amount of water besides organic liquids. Such studies were of importance in relation to water-based paints and effluent disposal.

Other themes of immediate interest were permeability of films, gel permeation chromatography of paint materials, and rheology of paints and inks in relation to performance. For the time being, it was not possible to deal with these items or others from the list. Though all these problems were of interest in general, a stricter definition of the objectives appeared necessary before work on them could be started. Also of considerable interest were, as the Chairman suggested, climatological studies, and the fate of the biocides and toxic substances of paints. This might, according to Mr. ZVONAŘ, be an appropriate subject for study in analytical terms. Mr. TAWN suggested analytical studies on trace amounts of metals and phthalates. Dr. WAPLER proposed the addition of studies on degree of curing to the list of topics.

The final outcome of the discussions was the adoption of the theme Polymer-Solvent Interaction for cooperative studies. Mr. TAWN AGREED to take the responsibility of this project and set up a programme. The Analytical Group, guided by Dr. O'NEILL, would finalize its present projects, then its Members would take an active part in the above project.

With respect to the current work on Adhesion, it was felt that some re-definition for it was necessary. This should, for the intermediate period, be coordinated by Dr. ZORLL supported by those Members of the Group concerned with adhesion and others to be invited.

Further continuing projects were those on Information Retrieval within the paint and ink field (Mr. RAASCHOU NIELSEN) and on Postgraduate Education (Prof. HAMANN). On the theme of biocides, toxic substances pollution and surroundings, Mr. RAASCHOU NIELSEN would collect information on legislation and regulations and suggest a procedure to deal with it.

Finally, in order to maintain a steady activity of SPF and the OCS Group, it was decided to have one meeting every year if possible, either in connection with conventions or separately in some central location. As much work as possible would, however, be done in the meantime by correspondence.

Appendix I

I. *Projects Terminated or In Progress*

(i) *Analytical Group* (Project Leader: Dr. O'NEILL). This Group had undertaken four projects in the last 5 years.

Alkyd Resins. Experimental work had been completed, with a report written and published as 'Recommended Methods for the Analysis of Alkyd Resins' in *Pure and Applied Chemistry*. Reprints were available and it was suggested that these should be circulated for Members to arrange for reviews in appropriate journals in their own countries. The following preliminary list of Members who would review the alkyd booklet was set up:

UK	TAWN/O'NEILL
Scandinavia+Japan	RAASCHOU-NIELSEN
Netherlands	DE LA COURT
Belgium	TOUSSAINT
France	PETIT (O'NEILL)
Germany (Farbe und Lacke+Defazet)	ZORLL

Germany (Fette Seifen Anstrichmittel)	WAPLER
USA	GLASER
Italy	PAGANI
Czechoslovakia + USSR	ZVONAŘ

Drs. O'NEILL and ZORLL would complete the list and Mr. FINK-JENSEN would then take care of the distribution.

Acrylic Resins. Experimental work on the cooperative analytical study had been completed, the report written, and it was ready for publication. This would probably be in the *Journal of Paint Technology*, formal approval for which from IUPAC was expected.

Urethane Resins. Experimental work had been completed and a report would be written by Mr. CHRISTENSEN and Dr. O'NEILL in similar style to the acrylic resin paper. This might well be published in the *Journal of the Oil and Colour Chemists' Association*.

Polyamide Resins. Six laboratories were taking part in this exercise. Three written reports and one verbal report had so far been received and the actual compositions had now been disclosed to these collaborators. In general, identification of the amine components was correct, but there were several omissions and errors with the acids. Further experimental work would be carried on up to the end of the year.

(ii) *Adhesion Group* (Project Leader until the end of the meeting: Dr. VAN LAAR). It was reported by Dr. VAN LAAR that an unsufficient number of notes on the pertinent literature on adhesion, its phenomena as well as methods of measurement, had been collected thus far. Some organizational modifications were necessary in order to accomplish the original objective of compiling the existing knowledge in a form suitable for an IUPAC-style publication.

With respect to existing possibilities to measure adhesion under exact experimental conditions, Dr. WAPLER gave a report of extensive studies about the tear-off method carried out in his laboratory. It was mentioned that the results of measurement could be influenced markedly by the following parameters of the system of measurement: occurrence of a bending moment during the tear-off process, diameter of the cylinder, demarkation of the glued zone at the edge of the cylinder, form of cylinder and mode of force transmission to it within a tensile testing machine, mode of clamping the substrate of film, rate of deformation. Moreover, the following factors of the film and the glue layer were of importance: glue line must be free from stress, curing to be made at normal or elevated temperature, distribution of forces in the test layer, order of magnitude of geometrical deformation of the paint film subjected to the force, relationship between this deformation of paint film and glue layer as well as the deformation of the cylinder. The system used could be operated without generating bending moments. The diameter of cylinders varied between 10 and 30 mm. A maximum of adhesion force could be observed at a certain diameter: the reason for that could be found in an optimum distribution of force all over the test surface. With small diameters, the scatter of results was often fairly great because of edge effects.

(iii) *Information Retrieval Group* (Project Leader: Mr. RAASCHOU NIELSEN). The progress in obtaining information about useful sources of literature was reported by Mr. RAASCHOU NIELSEN. The basis of that action was the combination of data about various service systems for literature, which had been obtained by means of a questionnaire sent out to some 46 institutions all over

the world. A reply was received from 22 of them, of which 17 had access to a literature service, while the remainder could not name such in adequate form. In finding out these institutions, assistance was given by DE WINTER ANDERSON (UK Paint Research Station), ZVONAR (Research Institute for Synthetic Resins and Lacquers, Czechoslovakia), and various Members of OCS. The worldwide directory of national technical information services, published by the Federation Internationale de Documentation in 1970, was also used. Moreover, Mr. RAASCHOU NIELSEN presented a special literature service about environmental control that had been worked out with the assistance of the Scandinavian Paint and Printing Ink Research Institute. It gave a classification and a summary of the contents of articles that were mainly concerned with legislative decisions and the like about the topic.

(iv) *Postgraduate Education Group* (Project Leader: Prof. HAMANN). In order to support the efforts to collect material on this issue, information was given by Mr. TAWN about the Industrial Training Board in UK. Similar details were available of the possibilities of postgraduate education training of paint chemists in Federal Republic of Germany. It was emphasized in the discussion that the problems of recognition of education levels across the borders should be studied more intensely by the Group in its future work.

2. Continuation of Work and New Projects

2.1. Additional Work in Existing Groups

(i) *Analytical Group*. In continuation of its current programme, the compilation of analytical methods, especially of acrylic, polyurethane, and polyamide resins, was to be concluded. The composition of the Group was the following: O'NEILL (Chairman), CHRISTENSEN, DE LA COURT, RAASCHOU NIELSEN, TOUSSAINT, TAWN, ZVONAR.

(ii) *Adhesion Group*. It was necessary for the Group to redefine its programme in terms of objectives and their relevance to the paint field. The material collected by Dr. VAN LAAR should be examined in order to find out whether a better understanding of various adhesion phenomena observed in typical paint film-substrate systems could already be obtained from it. It was proposed that for this intermediate period, the Secretary should organize the Group's further work. There was also the proposal to take into consideration instrumental work carried out by DAEBERG. Finally, it was felt that for further work, the experience existing in the field of adhesives should be taken into consideration. The Group had the following composition: ZORLL (Chairman), VAN LAAR, FINK-JENSEN (as correspondent), OESTERLE (as correspondent), RAASCHOU NIELSEN, WAPLER.

(iii) *Information Retrieval Group*. A last effort would be made in order to get a response from institutions in DDR, France, Italy, India, Israel, Japan, Poland, and USSR. A personal circular letter would be issued. Some of the Members were willing to assist Mr. RAASCHOU NIELSEN in obtaining the information needed. In order to supplement the information about various literature service systems, Mr. RAASCHOU NIELSEN would contact the Members of IARIGAI. He accepted that his institute could act as a clearing centre for legislation concerning aspects of environmental control, and he would contact the Members accordingly. At present, the Group was formed by: RAASCHOU NIELSEN (Chairman), FINK-JENSEN.

(iv) *Postgraduate Education Group*. It was felt that continuation of the work to make information about educational facilities available would be useful, but that changes and tendencies should also be observed. Since obtaining

the correct data was highly dependant on sufficient knowledge about national curricula, all SPF Members should submit relevant material to Prof. HAMANN, so that it might be collated and arranged for providing a survey of the present possibilities.

2.2 New Projects

(i) *Existing Proposals.* As interesting in principle, but not yet in any case appropriate for treatment in detail, the following topics, already compiled at the 1972 Teddington meeting, were discussed:

- (a) Phenomena of film formation. This theme should be formulated in more detail.
- (b) Interaction of high molecular weight material with solid surfaces. Because it was felt that much work was already done about this subject, further programmes must be carefully selected. The similarity with the studies on adhesion were mentioned.
- (c) Influence of dispersion grade on film properties. Though this theme was appealing, it should be divided into more special ones, because such different topics as gloss or reinforcing character both belonged to it.
- (d) Test methods for paints. Other institutions were carrying out intensive work in this field so that the item to be studied should be well defined.
- (e) Permeability of film. This might be a useful theme, if pertinent effects such as diffusion, swelling, ion exchange, and the like, could be studied separately. The results should be combined for explaining permeation effects.
- (f) Ion exchange in a film. This topic had a relationship with permeability as well as with the protective function of film, but no specific task was seen on hand at the moment.
- (g) Chemical reactions in thin layers. Because this theme was closely related to environmental studies, it could become an interesting item for further work.
- (h) Physical properties and their connection with film performance. This topic, of great importance to paint specialists, was not interesting to the same extent for the Macromolecular Division, so that it might be only considered as a theme for future work.
- (i) Rheological properties such as brushability. With respect to its technical importance, it was felt that work on this theme might be useful.

The following items were added at the Munich meeting:

- (j) Climatological studies. Because this issue had no special appeal to the Macromolecular Division, it should be considered more as a theme for OCS Group studies, if necessary.
- (k) Biocides in paints. This environmental topic required much analytical activity, but it would be very important with respect to the ultimate fate of such ingredients as phthalates, chlorinated diphenyl, and the like.
- (l) Degree of curing. Although this might be considered as too technological from an IUPAC point of view, the basic aspects of the theme should justify pertinent studies.
- (m) Molecular and viscous flow in and along interfaces. This special theme was thought to be interesting, but should be better defined before work on it could be started.

(ii) *New Project: Solvent-Polymer Interaction.* The scope of this theme ranged from general interest in basic phenomena to such effects as migration in

printing ink layers on food wrappings, which might even exclude some materials from use for this purpose. Methodical studies, including those making use of gas chromatography, were felt to be adequate here. A new Group, in combination with the Analytical Group, with the task to work on this item, was formed, of which the composition was as follows: TAWN (Chairman), FINK-JENSEN, OESTERLE, O'NEILL, VAN LAAR, SPOOR, ZORLL. The four first mentioned persons constituted a starting Group for planning the project.

(iii) *Project in Preparation: Behaviour of Concentrated Polymer Solutions.* Because this topic was important for treatment of effluent disposal or for water-based paints, and was also in the range of interest of macromolecular chemists, it was considered that studies on it should be organized, if circumstances would allow implementation.

SECTION ON WATER QUALITY (VI.7)

23-25 August 1973

Present: Dr. S. FREYSCHUSS (Chairman), Dr. P. N. J. CHIPPERFIELD (Vice-Chairman), Mr. B. GÖRANSSON (Secretary), Dr. P. R. L. A. DALQ, Dr. P. GRAU, Prof. E. A. PEARSON (Titular Members); Dr. E. VASSEUR (Associate Member).

1. A report of the meeting of the Section held at Brixham on 29 March 1972 had been published in the *Information Bulletin* [No. 44 (December 1972), pages 29-30].

2. Reports were given by Members on recent progress made in water pollution abatement in some industrial branches.

Dr. FREYSCHUSS gave a report regarding the pulp and paper industry. In Sweden, Finland, Canada, and the northern parts of USA, still 80-90% of the total BOD discharge emanated from the pulp and paper industry. Rationalization of the structure of pulp production in those countries had resulted in many sulfite mills with Ca-base being closed down and replaced mainly by kraft pulp mills. In kraft pulp mills, pollution problems were easier to solve by internal measures. Recent advances to reduce the pollutants from kraft pulp industry had consisted of better washing, which had reduced the washing loss to less than 1%. Another process stage where the possibilities to reduce the amount of pollutants were favourable, was bleaching. Three different means to achieve this were:

- (i) oxygen bleaching
- (ii) ion exchange
- (iii) lime treatment of effluents

Oxygen bleaching made it possible to reduce back water from bleaching for pulp washing, which resulted in reduction of the colour of the effluent by 90% as well as of the BOD. The ion exchange technique could be an alternative for those who still had chlorine bleaching. About 40-50% of the remaining BOD and practically all colour could be reduced. The economy of the process depended on the lifetime of the ion exchange resin. The latter was regenerated by sodium hydroxide and the regenerate could be returned to the black liquor.

Dr. TROBISCH gave a report of recent advances and experiences in chemical industries. The present research was concerned mainly with the problem of treating highly concentrated waste water from chemicals production in plants permitting relatively high load. Biological treatment was preceded in all plants by a chemical treatment step, which in its simplest form consisted in neutralization with lime or sodium hydroxide. For sludge separation purposes, flotation was being considered as a better solution than sedimentation. It was becoming more difficult to dispose of dewatered sludge on refuse tips. Therefore, incineration of the sludge in multibed furnaces or composting together with municipal refuse were beginning to be employed. Owing to problems of smell, it had become more and more common to have special neutralization and primary clarification tanks covered. Thermic purification of highly concentrated waste water from production of intermediates for polyester fibres had been tried with success. Thermic purification operated more efficiently the higher was the concentration of the waste water. For waste waters with a BOD below 10-20,000 mg/l. biological degradation was preferable. The treatment of waste water with a relatively high content of

salts and acids in addition to organic constituents, was a special problem. However, experiments had shown that sufficient degradation was possible with waste water containing concentrations up to 10 g of salt/l. Waste sulfuric acid containing organic contaminants could be concentrated by evaporation under certain conditions and reduced with fuels to sulfur dioxide, which could be recycled to sulfuric acid production.

The development of waste water treatment technology for the chemical industry was for the moment much concerned with improving the biochemical treatment process. Fermentation technology had been tried on an industrial scale on concentrated waste water from an acetaldehyde production plant. The use of pure oxygen instead of air in the activated sludge process had also been tried. Such processes were of special interest for highly odorous waste water when the basins were covered. Various studies had demonstrated that high oxygen concentration in the activated stage could cope better with flocculations in the waste water composition. The economic use of oxygen in biological processes greatly depended on the price of the oxygen. For elimination of organic substances that were not biodegradable, activated carbon absorption plants were likely to become important in the future.

Dr. DALCQ summarized the trends in the treatment of waste water from inorganic chemical industries. For removal of suspended solid, the use of flocculation processes and precipitation aids was becoming more frequent as well as the use of more technically advanced separation processes, such as flotation. For treatment of waste water with respect to soluble matter, such as metal ions, ion exchange techniques were more and more employed and to some extent reverse osmosis and electrodialysis.

Dr. GRAU reported on some aspects of treatment of phenolic wastes. The low production costs of synthetic phenols had made it unprofitable to recover phenol from wastes from coke plants and coal byproducts recovery plants. The costs for treatment of phenolic wastes were equal to the costs for production of synthetic phenol. Competitive methods to treat phenolic wastes were mainly biological treatment at the plant or discharge to municipal treatment plants, the latter method being possible when a duplicate sewage system was at hand. An unsolved problem with biological treatment was the high concentration of phenols, which in some cases could be toxic to the activated sludge.

Dr. CHIPPERFIELD gave a report on the present situation for water pollution abatement in the food industry. The most essential treatment system generally consisted of treatment on plastic media trickling filters in one, two, or three stages, followed by an activated sludge stage. Such systems had proved satisfactory for potato processing industries. In the vegetable canning industries, the system could be combined with sand filtration and activated carbon treatment if recovery of water was wanted. Fruit drink factories could encounter trouble with breakthrough of bacteria so that a final mild chlorination was employed. Reverse osmosis had proved to be a good alternative to activated carbon treatment. Trials were being made with high rate reaction aerated digestion of concentrated wastes.

3. Further development of cooperation with the International Association on Water Pollution Research (IAWPR) was discussed. It was decided that joint sponsorship of meetings should be considered whenever appropriate and that the Section should take advantage of an offer to use the facilities of IAWPR for publication of papers (the journal *Water Research*) together with the facilities of IUPAC.

4. The Section held a joint meeting with the Fermentation Industries Section (see page 241), which resulted in a draft programme for a Symposium on Microbiological Aspects on Effluent Treatment. It was decided that the two Sections should approach IAWPR to explore the possibilities to arrange this Symposium jointly with the IAWPR conference in Paris during September 1974.

5. The tentative scientific programme for the XXV IUPAC Congress (Jerusalem, 1975) was discussed with respect to subjects relevant to water quality. The Section decided to recommend to the Organizing Committee of the Congress that the Section assumed responsibility for a one day programme covering the following subjects:

- (i) "waste banks" as a solution to industrial waste problems
- (ii) reuse and disposal of waste acids

The Section further recommended that the subject 'Industrial Use of Water' should be omitted and that the scope of the subject 'Chemical Methods for Reduction of Environmental Pollution' ought to be more restricted and more clearly defined.

6. The work within ISO/TC 147 (Water Quality) was briefly discussed. It was established that up to now very little substantial results had arisen from TC 147, but that the present arrangement with the Section having an Associate Member as IUPAC representative on TC 47, together with agreement between IUPAC and ISO that the Union would receive all working papers for comment, was sufficiently satisfactory from the Section's point of view.

7. The Section decided to arrange a II International Congress on Industrial Waste Water in Stockholm at the beginning of 1975 or the end of 1974. The Congress should deal with recent advances in water pollution abatement within chemical, food, pulp and paper, and metal industries. Furthermore, there should be sessions on monitoring and control of effluents and on relation of treatment and ecological effects. The emphasis of the Congress should be on internal measures and recirculation and disposal of waste water and wastes.

8. The Section decided to recommend that Prof. PEARSON should continue as IUPAC representative on the COWAR Committee of ICSU.

9. The Section discussed the present and future waste for IUPAC to handle environmental questions. It was established that at present many of the Sections in the Applied Chemistry Division were partly dealing with environmental questions, but that the coverage of the field was irrational and that coordination of programmes between Sections could be better. It was decided that the Section should bring to the attention of the Division Committee that a more rational way to handle environmental questions could be to reorganize the Division to have just one "Environmental Section" with Commissions on relevant areas, such as "Air Quality", "Water Quality", "Solid and Liquid Waste Disposal", etc.

OPEN MEETING OF APPLIED CHEMISTRY DIVISION

26 August 1973

1. Introductory Remarks

The Division Vice-President (President-Elect), Dr. H. EGAN, welcomed all Members of the Division present. He invited the meeting to stand for a moment in memory of Dr. I. BOSUND, Member of the Division Committee who had died unexpectedly in July.

The minutes of the previous Open Meeting of the Division held in Washington, DC, 19 July 1971, were approved as recorded on page 268 of *Comptes Rendus XXVI Conference*.

Dr. EGAN reported that Dr. R. W. CAIRNS, Division President, had a conflict between the IUPAC Conference and the semiannual meeting of the American Chemical Society of which he was Executive Director, being held this week in Chicago. Although Dr. CAIRNS had been in the chair for the meeting of the Division Committee on 21 August, and had visited the meetings of a number of Sections, he had left for Chicago on 24 August and would return to Munich on 29 August to make final approvals and tie up loose ends of the meeting for the Division.

Dr. EGAN then commented on the points of Division philosophy recorded in the Minutes of the Division Committee Meeting of 21 August 1973 (see page 215). The Division Committee needed to exercise stronger control than it had in the past on Section programmes in order to ensure progress in the two principal problems facing the Division: (i) activation and diversification of programmes, and (ii) environmental issues.

The work of a number of Sections in the Division was largely analytical and there were many areas in which Sections could diversify. It was within the purview of the Applied Chemistry Division to do applied analysis so long as the proportion of analytical work was appropriate in relation to the breadth of the field covered by the Section and there was appropriate liaison with the Analytical Chemistry Division. Many Memberships in the Sections expired in 1975. Therefore, this was the time to plan for 1975 and look for new Members who could help in the diversification.

2. Summary of Information from Open Meeting on IUPAC Activities

Dr. EGAN summarized items from the Open Meeting (25 August 1973) which were of particular interest to the Division. The question of obtaining better publicity for IUPAC was discussed. Suggestions were made that Company Associates might come together at an IUPAC Conference to discuss their own views. Also, Company Associates in a given country might meet to provide a national forum.

A question was raised about the rationale for an Applied Chemistry Division when a number of the other IUPAC Divisions also had an applied content. It was pointed out that for the present the Applied Chemistry Division and the Macromolecular Division had a large fraction of the industrial Members of IUPAC bodies. Finally, comments were made regarding the absence of coverage of the heavy chemicals industry in the Division.

3. Communications and Division Organization

Dr. A. LANGLYKKE stated that he felt there were good reasons for reorientation of the work of the Sections, especially in regard to their functions and objectives. He observed that in the past there had been poor communication between the Sections and the Division Committee. The Bischenberg meeting in 1972 was the first time he recalled having an opportunity as a Section Chairman to sit down with the Division Committee and discuss the programmes of his Section.

The Division Committee should be aware of the work of the Sections; and the leaders of the Sections should be aware of the broad guidelines and objectives under which the Division Committee was operating. There should be better communication mechanisms for project approval, evaluation of projects as they proceeded, and publication. Things sometimes got sidetracked too much in dealing with the Secretariat.

Dr. LANGLYKKE observed that the suggestion made in the past to abolish Sections and to do all the Division's work in Commissions with limited life would not be practical, because the Division would not on this basis get good problems from Company Associates. There was a need for expert groups to define properly the project, *e.g.*, single cell proteins. These expert groups (Sections) would furnish continuity and expertise from around the world. Furthermore, the expert group was in the best position to know what were the important problems facing an area. However, they must be able to justify their programmes to the Division Committee.

Dr. EGAN agreed with the need for better communication and said he would like to see some mechanisms developed whereby the information became available without detailed reporting procedures.

4. Reports on Section Activities

The Section Chairmen gave summary reports of the activities of their Sections. These reports covered a number of points which were referenced in the minutes of the Division Committee Meeting held on 21 August 1973, and which would appear in the detailed minutes published by each Section in *Comptes Rendus XXVII Conference*.

Among specific points which should be mentioned was the proposal reported by Dr. LANGLYKKE to change the name of Section VI.2 to 'Fermentation Section', because its work concerned the microbial process in its many ramifications. In the discussion, Dr. K. A. WILLIAMS brought out the need for a clearing house within IUPAC for methods of analysis. Dr. EGAN thanked the Chairmen for their reports and all Division Members present for the hard work that was being done on Division programmes.

5. Elections

Dr. W. W. MEINKE (Division Secretary) read part of a letter from Dr. CAIRNS to the effect that Dr. CAIRNS had offered his resignation effective 1 September 1973, because of his candidacy for the Vice-Presidency of the Union. If this resignation was accepted by President BÉNARD, Dr. EGAN would automatically become President of the Applied Chemistry Division because this was implied in the election by the Division Committee of Dr. EGAN in 1971, and had been ratified by the Division Committee more recently. Dr. CAIRNS would therefore succeed Dr. W. GALLAY on the Division Committee as Past-President. Dr. MEINKE had submitted his resignation as Secretary, effective 1 September 1973, to permit the Division Committee to

chose a Secretary geographically closer to Dr. EGAN. Dr. MEINKE confirmed his interest in completing his four-year term as a Division Committee Member.

Thus, with the death of Dr. BOSUND, the Division Committee presently numbered six persons: Dr. EGAN, Dr. CAIRNS, Dr. CRESPI, Dr. MEINKE, Prof. SUOMALAINEN, and Dr. WEISSERMEL, and there were four vacancies. Forms for nomination of Division Committee Members had been distributed to Section Chairmen at the Division Committee Meeting on 21 August 1973. In response, there were four nominations for Membership: Dr. A. J. COLLINGS, Dr. J. A. EPSTEIN, Dr. A. F. LANGLYKKE, and Dr. W. G. STOLL.

After ascertaining that no additional nominations were forthcoming from participants at the Open Meeting, Dr. EGAN pointed out that these four nominations matched the four vacancies available. He called for confirmation of the election of these four persons by Division Members present. Drs. COLLINGS, EPSTEIN, LANGLYKKE, and STOLL were duly accepted for Membership of the Division Committee.

6. Discussion of Division Policy

Dr. EGAN enlarged on his previous remarks regarding the need for diversification and for consideration and coordination of environmental programmes. There ensued considerable discussion, including preliminary comments by Dr. FREYSCHUSS of a proposal which would be made by the Water Quality Section to set up an Environmental Section with four Commissions: Air Quality, Water Quality, Solid Waste, and Chemical Waste and Products. It was pointed out that this Environmental Section might be the contact body in IUPAC for SCOPE.

Dr. EGAN outlined plans for studying with Section Chairmen the best approach for diversification and environmental problems before the Division Committee meeting in the summer of 1974, and he affirmed that Dr. FREYSCHUSS' proposal and others originating within the Sections or within the Division Committee, would be considered. He invited all Section Members to communicate their views to him, through their Section Chairmen, on the organization within IUPAC of environmental matters and on the activation and diversification of Section programmes. Dr. P. R. L. A. DALCQ, a Section Member from industry, stated that one major problem was what should IUPAC do for industry. He felt that IUPAC was a unique point of meeting of scientists and industry, and therefore it was in a strong position to help coordinate efforts of these two groups. At present there was a continual dialogue between government and industry which imposed many requirements. IUPAC was in a position to help define the problems at the heart of this dialogue, and as a neutral, nonpolitical organization, it could serve as a helpful intermediary.

Also Dr. EGAN raised the question of guidelines for dealing with financial restriction within the Division, when these arose.

Dr. EGAN thanked the Members of the Division for their remarks which would be taken into account by the Division Committee as statements on Division policy were developed. In closing the meeting, Dr. EGAN also expressed the thanks on behalf of Division Members to Dr. CAIRNS for his forceful leadership of the past two years.

LIST OF ABBREVIATIONS

ACS	American Chemical Society
AFCAT	Association Française de Calorimétrie et d'Analyse Thermique
AOAC	Association of Official Analytical Chemists
AOCS	American Oil Chemists' Society
ASIDIC	Association of Scientific Information Dissemination Centres in USA
ASTM	American Society for Testing and Materials
BAM	Bundesanstalt für Materialprüfung in Federal Republic of Germany
BIPM	Bureau International des Poids et Mesures
CAS	Chemical Abstracts Service
CBN	IUPAC-IUB Commission on Biochemical Nomenclature
CEE	Communauté Européenne Economique
CEI	Commission Electrotechnique Internationale
CID	Comité International des Dérivés Tensio-Actifs
CIPAC	Collaborative International Pesticides Analytical Council
CIPM	Comité International des Poids et Mesures
CNA	Chemical Notation Association
CNOC	IUPAC Commission on Nomenclature of Organic Chemistry
CNRS	Centre National de la Recherche Scientifique in France
CODATA	ICSU Committee on Data for Science and Technology
COMECON	Council of Mutual Economic Assistance of Communist Nations
COSPAR	ICSU Committee on Space Research
COWAR	ICSU Committee on Water Research
CQUCC	IUPAC Commission on Quantities and Units in Clinical Chemistry
ECE	UN Economic Commission for Europe
EFEMA	European Food Emulsifier Manufacturers' Association
EPA	US Environmental Protection Agency
EPPO	European Plant Protection Organization
EUSIDIC	European Association of Scientific Information Dissemination Centres
FAO	UN Food and Agriculture Organization
FATIPEC	Fédération d'Associations de Techniciens des Industries des Peinture
FECS	Federation of European Chemical Societies
FSPT	US Federation of Societies of Paint Technology
GIFAP	Groupeement International des Associations Nationales de Fabricants de Pesticides
IAEA	International Atomic Energy Agency
IAPT	International Association of Plant Taxonomy
IARC	WHO International Agency for Research on Cancer
IARIGA	International Association of Research Institutes for the Graphic Arts Industry
IAWPR	International Association on Water Pollution Research
ICC	International Association for Cereal Chemistry
ICSU	International Council of Scientific Unions
ICSU AB	ICSU Abstracting Board
ICTA	International Confederation for Thermal Analysis
IDCNS	IUPAC Interdivisional Committee on Nomenclature and Symbols

IDF	International Dairy Federation
IFCC	International Federation of Clinical Chemistry
IMA	International Mineralogical Association
ISE	International Society of Electrochemistry
ISO	International Organization for Standardization
ISO/TC	ISO Technical Committee
ISO/TC SC	ISO/TC Sub-Committee
IUB	International Union of Biochemistry
IUCr	International Union of Crystallography
IUFoST	International Union of Food Science and Technology
IUGS	International Union of Geological Sciences
IUPAB	International Union of Pure and Applied Biophysics
IUPAP	International Union of Pure and Applied Physics
MAFF	UK Ministry of Agriculture, Fisheries, and Food
NAS-NRC	National Academy of Sciences-National Research Council in USA
NATO	North Atlantic Treaty Organization
NBS	US National Bureau of Standards
NIH	US National Institutes of Health
NPL	UK National Physical Laboratory
OCCA	Oil and Colour Chemists' Association in UK
OECD	Organization for Economic Cooperation and Development
OICC	Office International du Cacao et du Chocolat
OSTI	UK Office of Scientific and Technical Information
PAG	Protein Advisory Group of FAO/WHO/UNICEF
PTB	Physikalisch-Technische Bundesanstalt in Federal Republic of Germany
SAC	Society for Analytical Chemistry in UK
SCI	Society of Chemical Industry in UK
SCOPE	ICSU Scientific Committee on Problems of the Environment
SI	Système International
SLF	Federation of Scandinavian Paint and Varnish Technicians
SUN	IUPAP Commission for Symbols, Units, and Nomenclature
TRC	Thermodynamics Research Center at Texas A & M University
UN	United Nations
UNESCO	UN Educational, Scientific, and Cultural Organization
UNICEF	UN Children's Fund
UNIDO	UN Industrial Development Organization
UNISIST	UNESCO-ICSU Programme on International Science In- formation System
WHO	UN World Health Organization
WMO	World Meteorological Organization

XXIV IUPAC CONGRESS
Hamburg: 2—8 September 1973

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